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*Grand Canyon National Park
Draft Resources Management Plan
July 3, 1994*

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06/29/94

PROJECT LIST (on disk)

CULTURAL RESOURCES PROJECT STATEMENTS (46)

PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED	
0	GRCA-C-110.000	94	INCREASE CULTURAL RESOURCE MANAGEMENT STAFF		0.00		
170.00	0	GRCA-C-110.002	94	HIRE HISTORIAN		0.00	160.00
	0	GRCA-C-110.003	94	HIRE HISTORIC ARCHITECT		0.00	160.00
	0	GRCA-C-130.001	94	LIAISON WITH INDIAN TRIBES		20.00	
0.00	0	GRCA-C-220.000	94	MAINTAIN ORAL HISTORY PROGRAM		0.00	0.00
	0	GRCA-C-220.018	94	PROTECT ORAL HISTORY COLLECTION		0.00	5.00
	0	GRCA-C-220.020	94	COLLECT ORAL HISTORY INTERVIEWS WITH CCC WORKERS		0.00	32.00
	0	GRCA-C-220.030	94	DEVELOP ORAL HISTORY PROGRAM		0.00	42.00
	0	GRCA-C-230.000	94	IMPROVE MUSEUM COLLECTION STORAGE		0.00	0.00
	0	GRCA-C-230.016	94	DEVELOP FIRE PROT. & SECURITY FOR MUSEUM COLLECTION		0.00	0.00
	0	GRCA-C-230.017	94	COMPLETE HISTORIC BOAT STORAGE FACILITY		0.00	450.00
	0	GRCA-C-230.022	94	CONSTRUCT NEW MUSEUM STORAGE FACILITY		150.00	600.00
	0	GRCA-C-240.000	94	MAINTAIN HISTORIC PHOTOGRAPH COLLECTION		0.00	0.00
	0	GRCA-C-240.019	94	MAINTAIN PHOTOGRAPH COLLECTION		0.00	75.00
	0	GRCA-C-240.020	94	OBTAIN COPIES OF PHOTOGRAPHS IN OTHER COLLECTIONS		0.00	15.00
	0	GRCA-C-300.000	94	HISTORIC RESOURCES MANAGEMENT PROGRAM		0.00	0.00
	0	GRCA-C-300.009	94	DATA MANAGEMENT FOR HISTORIC RESOURCES		0.00	60.00
	0	GRCA-C-300.011	94	CONCESSION CONSULTATION ON HISTORIC RESOURCES MGMT.		0.00	5.00
	0	GRCA-C-310.000	94	ADMINISTRATIVE HISTORIES PROGRAM		0.00	0.00
	0	GRCA-C-310.014	94	PREPARE ADMINISTRATIVE HISTORY OF GRCA		0.00	77.00
	0	GRCA-C-320.000	94	COMPLETE HISTORIC RESOURCE STUDIES		0.00	0.00
	0	GRCA-C-320.001	94	PREPARE HRC ON ATSFRR & ITS PREDECESSORS		0.00	100.00
	0	GRCA-C-320.002	94	PREPARE HRS OF NPS DEVELOPMENT AT GRAND CANYON		0.00	77.00
	0	GRCA-C-320.005	94	PREPARE HRS OF UPRR/UTAH PEAKS CO. ON NORTH RIM		0.00	77.00
	0	GRCA-C-330.000	94	COMPLETE CULTURAL LANDSCAPE STUDIES		0.00	0.00
	0	GRCA-C-340.000	94	PRESERVE HISTORIC STRUCTURES		0.00	125.00
	0	GRCA-C-340.001	94	ESTABLISH IN-PARK PRESERVATION CREW		0.00	1350.00
	0	GRCA-C-340.002	94	COMPLETE KILB STUDIO HISTORIC FURNISHING PLAN		0.00	27.00
	0	GRCA-C-340.003	94	DEVELOPMENT OF HISTORIC PROPERTIES		0.00	0.00
	0	GRCA-C-340.004	94	REHAB POWELL MEMORIAL		0.00	0.00
	0	GRCA-C-340.005	94	HISTORIC AMERICAN BUILDINGS SURVEY OR HAER RECORDNG		0.00	0.00
	0	GRCA-C-340.006	94	FIRE PROTECTION FOR HISTORIC STRUCTURES		0.00	0.00
	0	GRCA-C-340.007	94	UPDATE LIST OF CLASSIFIED STRUCTURES		92.00	0.00
	0	GRCA-C-340.008	94	DEVELOP BUILDING PRESERVATION GUIDES WITH INVENTORY CONDITION ASSESSMENT PROGRAM		0.00	
0.00	0	GRCA-C-400.002	94	IMPLEMENT SYSTEMWIDE ARCHEOLOGICAL INVENTORY PROGRM		0.00	380.00
	0	GRCA-C-410.000	94	IMPLEMENT PROGRAM FOR ARCH. SITE IMPACT MONITORING		0.00	0.00
	0	GRCA-C-410.001	94	MONITOR ARCHEOLOGICAL SITES IN DEVELOPED AREAS		0.00	0.00
	0	GRCA-C-410.002	94	MONITOR ARCHEOLOGICAL SITES ALONG BACKCOUNTRY TRLS		0.00	320.00
	0	GRCA-C-410.003	94	MONITOR ARCHEOLOGICAL SITES ALONG COLORADO RIVER		0.00	360.00
	0	GRCA-C-420.000	94	DEVELOP MITIGATION PLAN FOR IMPACTS TO ARCH SITES		0.00	0.00
	0	GRCA-C-440.001	94	CONVERT EXISTING SITE FILES INTO ASMIS		0.00	140.00
	0	GRCA-C-500.000	94	CULTURAL RESOURCE INFORMATION MANAGEMENT PROGRAM		0.00	0.00
	0	GRCA-C-500.010	94	ENTER CULTURAL DATA INTO GIS DATABASE		0.00	50.00
	0	GRCA-C-500.020	94	OBTAIN COPIES OF ALL GCNHA BIBLIOGRAPHIC MATERIAL		0.00	
20.00	0	GRCA-C-500.035	94	COMPLETE CRBIB		0.00	10.00
80.00	0	GRCA-C-700.001	94	PREPARE ETHNOGRAPHIC OVERVIEW FOR GRCA		0.00	

Resource Type Sub-total-----


INTEGRATED PROJECT STATEMENTS (37)

0	GRCA-I-100.010	94	INVENTORY SPRING, SEEP, & RIPARIAN VEGETATION		0.00	165.00
0	GRCA-I-140.010	94	REHAB KNOWN WETLAND/RIPARIAN AREAS IMPACTED BY EXOT		0.00	30.30
0	GRCA-I-161.000	94	CONDUCT AND INTEGRATE THE PRESCRIBED FIRE PROGRAM		121.80	640.00
0	GRCA-I-200.000	94	MUSEUM COLLECTION MANAGEMENT PROGRAM		200.00	0.00
0	GRCA-I-200.001	94	PROVIDE CURATORIAL CYCLIC MAINTENANCE		54.00	200.00
0	GRCA-I-200.002	94	PROVIDE BASE FUNDING FOR MUSUEM COLLECTION		0.00	285.00
0	GRCA-I-200.003	94	WRITE COLLECTION MANAGEMENT PLAN		0.00	15.00
0	GRCA-I-210.000	94	MAINTAIN THE MUSEUM COLLECTION		0.00	0.00
0	GRCA-I-210.020	94	INVENTORY MUSEUM COLLECTION		0.00	25.00
0	GRCA-I-210.021	94	MICROFICHE MUSEUM COLLECTION MATERIALS		5.00	20.00
0	GRCA-I-210.023	94	DEVELOP PHOTO DOCUMENTATION OF MUSEUM COLLECTION		0.00	80.00
0	GRCA-I-210.024	94	COMPUTERIZATION OF MUSEUM COLLECTION		0.00	60.00
0	GRCA-I-210.028	94	CATALOG BACKLOG OF MUSEUM SPECIMENS		0.00	5.00
0	GRCA-I-240.102	94	INCREASE PARTICIPATION IN INTERAGENCY PROGRAMS		20.00	20.00
0	GRCA-I-310.020	94	PREPARE ADMINISTRATIVE HISTORY OF NAT. RES. MGMT.		0.00	52.00
0	GRCA-I-320.003	94	PREPARE HRS ON RIM ROADS, TRAILS & BACKCOUNTRY		0.00	77.00
0	GRCA-I-320.004	94	PREPARE HRS ON TRAILS BELOW CANYON RIMS		0.00	77.00
0	GRCA-I-320.006	94	PREPARE HRS OF MINING IN GRCA		0.00	77.00
0	GRCA-I-360.201	94	EVALUATE IMPACTS OF GROUND WATER WITHDRAWALS		0.00	50.00
0	GRCA-I-430.001	94	ASSESS EFFECTS OF MGMT FIRES ON ARCH RESOURCES		0.00	70.00
0	GRCA-I-500.000	94	MANAGE CAVE RESOURCES		0.00	0.00
0	GRCA-I-500.015	94	MANAGE PARK LIBRARY		0.00	45.00
0	GRCA-I-500.025	94	OBTAIN COPIES OF GRCA MATERIAL IN OTHER REPOSITORY		0.00	50.00
0	GRCA-I-500.030	94	INFORMATION INTEGRATION WITH OTHER SERVICES		0.00	10.00
0	GRCA-I-500.040	94	NATIONAL TECHNICAL INFORMATION CENTER AND SYSTEM		0.00	10.00
0	GRCA-I-500.045	94	DESIGN & REPLACE SOUTH RIM VISITOR CENTER EXHIBITS		0.00	500.00
0	GRCA-I-500.050	94	SURVEY & INVENTORY COLLECTIONS		0.00	15.00
0	GRCA-I-510.001	94	DOCUMENT CAVE RESOURCES		0.00	16.00
0	GRCA-I-530.101	94	REVISE CAVE MANAGEMENT PLAN		0.00	26.00
0	GRCA-I-570.101	94	MAP AND INVENTORY CAVES		0.00	36.00
0	GRCA-I-650.000	94	MEET COMPLIANCE WITH SPECIAL DIRECTIVE 80-I		150.00	600.00
0	GRCA-I-800.001	94	BACKCOUNTRY RESEARCH AND MONITORING		40.00	180.00
0	GRCA-I-800.002	94	COLORADO RIVER VISITOR USE IMPACT MONITORING		72.00	260.00
0	GRCA-I-810.001	94	STABILIZATION & REHABILITATION OF HISTORIC TRAILS		0.00	600.00
0	GRCA-I-900.101	94	DEVELOP AND EXPAND GIS PROGRAM		120.00	188.00
0	GRCA-I-900.104	94	DEVELOP AN INTEGRATED DATA MANAGEMENT PLAN		0.00	20.00
0	GRCA-I-900.106	94	ESTABLISH INDEPENDENT SCIENTIFIC REVIEW PANEL		0.00	260.00

Resource Type Sub-total-----

NATURAL RESOURCES PROJECT STATEMENTS (115)

0	GRCA-N-010.000	94	INCREASE NATURAL RESOURCES MANAGEMENT STAFFING		1720.00	
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1640.00	0	GRCA-N-100.000	94	DEVELOP COMPREHENSIVE VEG. MONITORING PROGRAM	0.00	500.00
	0	GRCA-N-100.020	94	CONDUCT PARKWIDE RELICT AREA SURVEY	0.00	340.00
	0	GRCA-N-100.030	94	CONDUCT MONITORING ON ALTERED LANDSCAPES PARKWIDE	0.00	350.00
	0	GRCA-N-110.000	94	DEVELOP MUTIDISC. STUDIES TO DETERMINE PAST CLIMATE	0.00	330.00
	0	GRCA-N-111.000	94	RESEARCH GRASSLAND CHANGES DUE TO HISTORIC GRAZING	0.00	90.00
	0	GRCA-N-112.000	94	INVENTORY & MANAGE FOREST INSECTS & DISEASES	9.00	30.00
	0	GRCA-N-120.000	94	EXPAND FIRE EFFECTS MONITORING PROGRAM	23.00	100.00
	0	GRCA-N-121.000	94	EXPAND FIRE HISTORY STUDIES	0.00	80.00
	0	GRCA-N-130.000	94	SURVEYS AND REPORTS FOR SPECIAL STATUS PLANTS	10.00	210.00
	0	GRCA-N-130.010	94	DEVELOP PROTOCOLS FOR MONITORING PARK ECOSYSTEMS	0.00	551.00
	0	GRCA-N-130.020	94	CONDUCT SITE-SPECIFIC PROJECT COMPLIANCE SURVEYS	2.50	42.00
	0	GRCA-N-130.030	94	MANAGEMENT OF SENTRY MILK VETCH, A LISTED ENDANG SP		
119.00	0	GRCA-N-140.000	94	DEVELOP EXOTIC PLANT MANAGEMENT PROGRAM	0.00	960.00
	0	GRCA-N-150.000	94	CONTINUE AND UPDATE HAZARD TREE MANAGEMENT PROGRAM	12.00	120.00
	0	GRCA-N-160.000	94	DEVELOP A VEGETATION MANAGEMENT PLAN PARKWIDE	0.00	10.00
	0	GRCA-N-160.010	94	DEVELOP SITE REHABILITATION PLAN	0.00	8.00
	0	GRCA-N-170.000	94	MANAGE AND RESTORE ALTERED RIPARIAN SYSTEMS	0.00	320.00
	0	GRCA-N-171.000	94	REHABILITATE IMPACTED AREAS IN DEVELOPED ZONES	0.00	400.00
	0	GRCA-N-172.000	94	ESTABLISH VEGETATION MANAGEMENT CREW	0.00	1376.00
	0	GRCA-N-180.000	94	DEVELOP NATIVE PLANT PROPAGATION PROGRAM	28.00	600.00
	0	GRCA-N-180.010	94	EVALUATE EFFECTIVENESS OF REVEG PROTOCOL & PROGRAMS	0.00	32.00
	0	GRCA-N-200.101	94	INVENTORY ALL THREATENED, ENDANGERED & SENS. SPEC.	40.00	80.00
	0	GRCA-N-200.102	94	DISTRIBUTION & RISK STATUS OF KANAB AMBERSNAIL	0.00	31.00
	0	GRCA-N-200.103	94	CONDUCT SURVEY OF SPOTTED OWL POPULATION	0.00	20.00
	0	GRCA-N-200.104	94	INVENTORY & ASSESS SOUTHWEST WILLOW FLYCATCHER	124.00	0.00
	0	GRCA-N-200.106	94	MONITOR AND MITIGATE T&E SPECIES: RAZORBACK SUCKER	0.00	155.00
	0	GRCA-N-200.201	94	IMPLEMENT MONITORING PROGRAM FOR ALL T&E&S SPECIES	0.00	160.00
	0	GRCA-N-200.202	94	MONITOR COWBIRDS AT CORRALS & STOCK AREAS	0.00	10.00
	0	GRCA-N-200.203	94	MONITOR WILLOW FLYCATCHERS ALONG COLORADO RIVER	0.00	70.00
	0	GRCA-N-200.204	94	MONITOR PEREGRINE FALCON POPULATION	4.00	20.00
	0	GRCA-N-200.205	94	MANAGE THE HUMPBAC CHUB POPULATION	0.00	0.00
	0	GRCA-N-200.302	94	MANAGE COWBIRDS TO PROTECT SENSITIVE BIRDS	0.00	24.00
	0	GRCA-N-200.303	94	DETERMINE WILLOW FLYCATCHER POPULATION DYNAMICS	0.00	40.00
	0	GRCA-N-200.304	94	EVALUATE EFFECTS OF ALTERED THERMAL REGIMES	0.00	0.00
	0	GRCA-N-200.306	94	DETERMINE NEED TO CLOSE HABITAT OF KANAB AMBERSNAIL	0.00	6.00
	0	GRCA-N-200.307	94	GENETICS & AUTECOLOGY OF KANAB AMBERSNAIL	0.00	46.00
	0	GRCA-N-201.101	94	INVENTORY, MONITOR, MANAGE & PROTECT PARK MAMMALS	0.00	140.00
	0	GRCA-N-201.102	94	INVENTORY & MONITOR BIGHORN SHEEP	0.00	90.00
	0	GRCA-N-201.103	94	INVENTORY & MONITOR CARNIVORES	0.00	10.00
	0	GRCA-N-201.104	94	INVENTORY & MONITOR ELK & DEER	0.00	32.70
	0	GRCA-N-201.105	94	INVENTORY BAT POPULATIONS	0.00	100.00
	0	GRCA-N-201.106	94	INVENTORY, MONITOR & ASSESS INVERTEBRATES	0.00	120.00
	0	GRCA-N-201.107	94	INVENTORY TERRESTRIAL INVERTEBRATES	0.00	120.00
	0	GRCA-N-201.109	94	CONDUCT INVENTORY & ASSESSMENT: RAPTORS	0.00	80.00
	0	GRCA-N-201.110	94	CONDUCT INVENTORY & ASSESSMENT: CORRIDOR BIRDS	285.00	0.00
	0	GRCA-N-201.111	94	CONDUCT INVENTORY & ASSESSMENT: UPLAND BIRDS	0.00	90.00
	0	GRCA-N-201.112	94	INVENTORY SPRING, SEEP, & WETLAND INVERTEBRATES	0.00	132.00
	0	GRCA-N-201.113	94	AN HERPETOFAUNAL INVENTORY OF GRAND CANYON	0.00	110.00
	0	GRCA-N-201.115	94	INVENTORY AQUATIC INVERTEBRATES	0.00	0.00
	0	GRCA-N-201.200	94	IMPLEMENT MONITORING FOR ALL T & E & S SPECIES	0.00	160.00
	0	GRCA-N-201.201	94	MONITOR NATIVE FISH COMMUNITY IN THE COLORADO RIVER	0.00	160.00
	0	GRCA-N-201.203	94	MONITOR KAIBAB SQUIRREL POPULATION TRENDS	0.00	12.00
	0	GRCA-N-201.301	94	DEVELOP ENERGY FLOW AND MATERIAL CYCLING MODELS	0.00	390.00
	0	GRCA-N-210.101	94	MANAGE IPM PROGRAM	32.00	104.00
	0	GRCA-N-210.102	94	INVENTORY & MANAGE FOREST INSECTS & DISEASES	12.00	100.00
	0	GRCA-N-210.103	94	DEVELOP SPECIFIC IPM PLAN	0.00	5.00
	0	GRCA-N-210.104	94	INVENTORY & MONITOR VECTORS FOR HUMAN DISEASE	0.00	60.00
	0	GRCA-N-210.105	94	MANAGE HABITUATED/BEGGAR WILDLIFE	11.00	25.00
	0	GRCA-N-220.001	94	FEASIBILITY OF RIVER OTTER REINTRODUCTION	0.00	25.00
	0	GRCA-N-220.002	94	BIOLOGY & REINTRODUCTION OF BONYTAIL CHUB	0.00	30.00
	0	GRCA-N-220.003	94	BIOLOGY & REINTRODUCTION OF COLO. RIVER SQUAMFISH	0.00	30.00
	0	GRCA-N-230.101	94	VECTORS FOR NON-NATIVE SPECIES INTRODUCTION	0.00	66.00
	0	GRCA-N-230.102	94	MANAGE FERAL BURRO POPULATION	8.00	5.00
	0	GRCA-N-230.103	94	MONITOR NON-NATIVE FISHES, MITIGATE IMPACTS	0.00	450.00
	0	GRCA-N-240.101	94	RESEARCH AIRCRAFT IMPACTS ON WILDLIFE	0.00	165.00
	0	GRCA-N-240.104	94	IMPACTS TO WILDLIFE FROM ADJ. LAND TIMBER HARVEST	104.00	0.00
	0	GRCA-N-242.101	94	PERFORM CYCLIC BOUNDARY FENCE MAINTENANCE	12.00	40.00
	0	GRCA-N-250.101	94	ASSESS IMPACTS OF URBANIZATION ON WILDLIFE	0.00	10.00
	0	GRCA-N-300.000	94	MANAGE WATER RESOURCES	0.00	0.00
	0	GRCA-N-300.101	94	UPDATE WATER RESOURCES MANAGEMENT PLAN	0.00	35.00
	0	GRCA-N-310.201	94	DETAILED HYDROGEOLOGIC ASSESSMENT OF SOUTH RIM AREA	0.00	100.00
	0	GRCA-N-310.501	94	DESIGN A WATER RESOURCES MONITORING PROGRAM	0.00	11.00
	0	GRCA-N-310.502	94	LONG-TERM MONITORING OF WATER QUALITY & QUANTITY	0.00	120.00
	0	GRCA-N-330.201	94	FLOOD CONTINGENCY PLAN FOR CORRIDOR DEVELOPMENTS	0.00	10.00
	0	GRCA-N-330.401	94	MONITOR BACTERIA OF COLORADO RIVER & TRIBUTARIES	0.00	40.00
	0	GRCA-N-350.201	94	DELINEATE WETLANDS IN AREAS OF DEVELOPMENT	0.00	5.00
	0	GRCA-N-360.101	94	IDENTIFY ALTERNATIVE SOURCES OF POTABLE WATER	0.00	350.00
	0	GRCA-N-360.102	94	DEVELOP EIS INFORMATION FOR ALTERNATIVE WATER SUPP.	0.00	25.00
	0	GRCA-N-360.202	94	DEVELOP INFORMATION FOR TUSAYAN WATER SALES E.A.	0.00	10.00
	0	GRCA-N-360.501	94	ASSESS IMPACTS OF DIVERSIONS FROM ROARING SPRINGS	0.00	26.00
	0	GRCA-N-360.901	94	INTERPRET WATER SUPPLY AND CONSERVATION	0.00	2.00
	0	GRCA-N-390.101	94	SUPPORT NPS WATER RIGHTS CLAIMS FOR LITTLE COL. RIV	18.00	75.00
	0	GRCA-N-410.101	94	DEVELOP & MAINTAIN PALEONTOLOGIC LOCALITY DATABAS	0.00	45.00
	0	GRCA-N-410.102	94	INVENTORY AND PHOTODOCUMENT PALEONTOLOGICAL RESOURCES	0.00	
36.00	0	GRCA-N-430.001	94	PREPARE A PALEONTOLOGICAL RESOURCES MANAGEMENT PLAN	0.00	
12.00	0	GRCA-N-430.101	94	DEVELOP PALEONTOLOGICAL RESEARCH PROGRAM GUIDANCE	0.00	
8.00	0	GRCA-N-450.101	94	PRESERVE THREATENED PALEONTOLOGICAL RESOURCES	0.00	
9.00	0	GRCA-N-610.101	94	INVENTORY AND MAP PARK SOILS	0.00	40.00
	0	GRCA-N-640.101	94	EVALUATE GEOLOGIC HAZARDS	0.00	26.00
	0	GRCA-N-640.401	94	MANAGE AND RECLAIM ABANDONED MINERAL LANDS	0.00	140.00
	0	GRCA-N-640.402	94	RECLAMATION OF ORPHAN MINE SITE	0.00	350.00
	0	GRCA-N-700.000	94	MANAGE AIR QUALITY	0.00	0.00
	0	GRCA-N-710.001	94	DEVELOP AIR QUALITY MANAGEMENT PLAN	0.00	50.00
	0	GRCA-N-720.101	94	MONITOR VISIBILITY	100.00	0.00
	0	GRCA-N-720.601	94	IDENTIFY AIR QUALITY REALTED VALUES	0.00	8.00
	0	GRCA-N-730.101	94	INVENTORY IN-PARK AIR POLLUTION SOURCES & COMPLIANC	0.00	65.00
	0	GRCA-N-750.501	94	MONITOR BIOLOGICAL EFFECTS OF AIR POLLUTION	8.00	104.00
	0	GRCA-N-770.401	94	PARTICIPATE IN REGIONAL AIR QUALITY MANAGEMENT	0.00	160.00
	0	GRCA-N-800.003	94	DEVELOP TRAVEL SIMULATION MODEL FOR COLORADO RIVER	4.00	44.00
	0	GRCA-N-800.004	94	ADAPTIVE MGMT & LONG-TERM MONITORING OF COLORADO RV	0.00	0.00
	0	GRCA-N-800.005	94	RESEARCH & MONITOR NATURAL QUIET	0.00	52.00
	0	GRCA-N-810.002	94	REHABILITATION OF WILDERNESS RESOURCE IMPACTS	60.00	240.00

0	GRCA-N-810.003	94	DEVELOP WILDERNESS WASTE MANAGEMENT PROGRAM	0.00	200.00
0	GRCA-N-810.004	94	STUDY & MITIGATE STOCK USE IMPACTS	320.00	440.00
0	GRCA-N-810.005	94	MITIGATE ROAD IMPACTS TO THE BASIN MEADOW	0.00	83.00
0	GRCA-N-810.006	94	MANAGE AIRCRAFT OVERFLIGHTS		
160.00					
0	GRCA-N-820.001	94	UPDATE BACKCOUNTRY MANAGEMENT PLAN	12.00	140.00
0	GRCA-N-820.002	94	REVISE COLORADO RIVER MANAGEMENT PLAN	12.00	60.00
0	GRCA-N-830.001	94	UPDATE NEPA COMPLIANCE FOR WILDERNESS RECOMMENDATIO	0.00	100.00
0	GRCA-N-830.002	94	CONDUCT WILD & SCENIC RIVERS SUITABILITY STUDY	12.00	59.00
0	GRCA-N-900.102	94	DEVELOP GIS NETWORKING/DATA SHARING CAPABILITIES	3.00	10.00
0	GRCA-N-900.103	94	DEVELOP WILDLIFE-HABITAT RELATIONAL DATABASE	0.00	15.00
0	GRCA-N-900.105	94	IMPLEMENTATION OF INTEGRATED DATA MANAGEMENT	0.00	100.00
0	GRCA-N-900.107	94	DEVELOP & UPDATE BIOLOGICAL TAXON CHECKLISTS	0.00	1.00

Resource Type Sub-total-----

Grand Total=====

198 project statements

EXECUTIVE SUMMARY

DRAFT RESOURCE MANAGEMENT PLAN

Grand Canyon National Park
JULY, 1994

PURPOSE OF PLAN

The Resource Management Plan for Grand Canyon National Park provides a comprehensive overview of the park's natural and cultural resources and identifies actions that will enable the National Park Service to fulfill its legislative mandate to protect Grand Canyon in keeping with its true significance. These actions fall under various comprehensive resource management programs described herein. The programs guide appropriate management of park resources and serve as a tool for both park managers and the public to fully understand the scope of management techniques involved. Each of the identified actions, or project statements, contains not only a description of the recommended project and its alternatives, but also an estimate of the cost, environmental or cultural compliance and related projects needed to complete the action.

APPLICATION

The actions defined in the plan may be ongoing or planned and will be accomplished either with base funding or with additional funding allocated from the park, the Western Regional Office, the Washington Office or other sources. This document is also intended to be used by universities and friends groups who wish to assist Grand Canyon in accomplishing its resource management goals. Projects will be accomplished using existing park staff, volunteers, additional term or permanent staff, graduate students or by contract. Where possible, projects will be coordinated as part of the greater Colorado Plateau; involving all agencies, organizations and individuals charged with the management of resources within this region.

CONTENTS

- I. Introduction: describing how the plan is to be used and critical and legal information about park management; its purpose, significance, goals and objectives.
- II. Present Resource Status: comprehensively summarizing baseline information on the park's resources and their condition and identifying major issues which must be addressed in order to meet the goals and objectives identified in Chapter One.
- III. Resource Management Programs: outlining a step-by-step strategy for addressing each major issue as it relates to individual resource programs. This provides a context for understanding how individual project statements fit into a comprehensive strategy. This chapter describes current and unfunded resource management programs and logical priorities for action plans.
- IV. Project Statements: almost 200 individual actions for administering, staffing, and funding the inventory, documentation, monitoring, research, mitigation and/or protection and maintenance of park resources. This collection of project statements relates back to Chapter 3: Resource Management Programs.
- V. Appendices: including references used throughout the plan.
- VI. Addenda: including related material too voluminous to be included in this plan.

SPIRIT OF PLAN

The park purpose is dictated by its own enabling legislation (1919) and the National Park Service Organic Act (1916) as detailed in Chapter 1. Dedication to the preservation of the cultural and ecological integrity of the park requires a very broad perspective encompassing the entire Colorado Plateau contained within Utah, Colorado, New Mexico and Arizona. The ecosystem and cultural geography of Grand Canyon is an integral part of this greater eco-region and transcends political boundaries and jurisdictions. Resources management at Grand Canyon National Park cannot occur in a vacuum. Ecosystems must be understood and perpetuated in a comprehensive way. The area's cultural geography must be fully understood in order to comprehend the relationship of the past and present cultural influences in the region. This is not just a simple case of preserving favored species and isolated artifacts.

VISION, GOALS AND OBJECTIVES

The overall vision for the park comes from the GMP:

...Grand Canyon National Park is a place of tremendous beauty, peace and scenic grandeur, as well as a place of vast natural and cultural interests. The canyon is one of the world's most spectacular products of the combined natural forces of uplift and erosion, and as a world heritage site, it has been identified as a place of universal values to all people. In order to protect this magnificent place, the park should be managed to ensure the preservation of its ecological processes and historical and archeological resources. Proposed wilderness areas should be managed as wilderness, and appropriate adaptive reuse of historic structures should be encouraged while the historical integrity of the cultural landscape is preserved...

The goals and objectives used to support this vision are identified in Chapter 3, which sets the park's overall resource management program

WHAT HAPPENS NEXT

As the Resource Management Plan is implemented, completed projects will be deleted and additional project statements will be added. Issues and management objectives will evolve as research and monitoring reveal additional information. This is a dynamic document and is in looseleaf form.

PREFACE

WHAT HAS CHANGED

This document is a revision of the 1987 Resources Management Plan (RMP) produced for Grand Canyon National Park. A scoping session was conducted in February of 1994 to identify natural and cultural resource issues and projects. Because of the discussions at this session, and because of a request from the Western Regional Office that Grand Canyon update their RMP, the Resource Management Plan has been revised to include new issues, priorities and projects.

INTERDISCIPLINARY APPROACH

The Grand Canyon Resources Management Plan (RMP) is probably one of the most complex management documents that the park will produce. Although normally coordinated by the park's natural and cultural resources staff, the RMP is more than a division action plan. It is the road map for resource preservation and management. Resource management projects routinely involve shared responsibilities and interdivisional cooperation for successful development and implementation. Resource management issues often transcend park boundaries requiring the coordination of other state, federal and local agencies as well as Native American groups, private interests and landowners. Therefore, the approach taken for this RMP was interdivisional and interdisciplinary.

The February scoping session was attended by over 60 participants. Resource managers from the United States Forest Service, Arizona Game and Fish, United States Fish and Wildlife Service, Northern Arizona University Department of Forestry and Research, the Colorado Plateau Research Station of the National Biological Service, and

the Aldo Leopold Wilderness Research Institute all offered a non-National Park Service perspective. National Park Service staff representing both cultural and natural resource management offered perspectives from the Western Regional Office, Western Archeological and Conservation Center, Washington Division, Air Quality Office, Water Quality Office, Southern Arizona Group Office, Rocky Mountain Regional Office, Lake Mead National Recreation Area, and Glen Canyon National Recreation Area. The Grand Canyon National Park staff included maintenance, protection, fire, planning and design, interpretation, aviation, as well as cultural and natural resources management. The session was very productive in that many issues were identified and all participants helped generate program definition and numerous project statements. Native American groups were unable to attend, although they will be contacted at a later date as part of the planning process.

NPS PLANNING PROCESS

NPS-2, the National Park Service Planning Process Guideline, shows the Resource Management Plan as a supplement to the General Management Plan. The General Management Plan must:

...set forth the basic management philosophy for a park and provide the strategies for addressing issues and achieving identified management objectives over a 5- to 10-year period. Two types of strategies are presented in the GMP: those required to properly manage the park's resources, and those required to provide visitor use and interpretation of the resources. Based on these strategies, programs, actions, and support facilities necessary for

efficient park operation and visitor use are identified. Throughout the planning effort, the park is considered in a regional context that influences and is influenced by it . . .

General Management Plan

Resources Management Plan	Visitor Use Plan	General Development Plan
Water Mgt Plan	Backcountry Mgt. Plan	Development Concept Plan
Veg Mgt Plan	River Mgt. Plan	Preliminary Design
Fire Mgt. Plan	Interpretive Prospectus	Maintenance & Support Operational Guide
Wilderness Recommendation	Transportation Plan	Structural Fire Mgt. Plan
Historic Resource Study	Wayside Exhibit Plan	Sign Plan
Collections Mgt. Plan	SAR Plan	Trails Plan
etc.	etc.	etc.

NPS - PLANNING PROCESS

SCOPE OF THE RESOURCE MANAGEMENT PLAN

The purpose of this resource management plan and its five year program is: to identify, define and program specific activities such as inventory, monitoring, research, mitigation, maintenance and enforcement. These activities are required to perpetuate natural processes and natural and cultural resources in Grand Canyon National Park, to achieve the park purposes and management objectives, and to help regulate use of the park. This plan draws upon appropriate legislation and National Park Service policies and guidelines, as well as on a knowledge of the resources of this park and its special needs. This plan provides a basis for measuring resource accomplishments against documented inventory, monitoring, research, mitigation, maintenance and enforcement needs and commitments, and for making budget requests.

Management actions in the park will continue to be coordinated with the entire Colorado Plateau region and all of the federal, state,

county, Native American and private jurisdictions within. This plan is a flexible document. The proposals, priorities and funding estimates are intended as guides. It is recognized that these guides will necessarily be reviewed and updated periodically to meet the requirements of changing conditions.

ACTION PLANS

In some cases, resource management actions needed will be so complex and/or controversial that they cannot be adequately dealt with in this document. These require their own individual plans and are listed in the flow chart in the NPS Planning Process. The need for these plans will be identified in this document and their relevance to current management objectives and issues will be highlighted. Some of these plans will require public and peer review. Some examples include the Vegetation Management Plans, Fire Management Plan, Cultural Landscape Management Plans, River Management Plan, etc.

(insert graphic)

Chapter One: Introduction

Chapter One:

INTRODUCTION

In March of 1994, a Government Accounting Office (GAO) Report on *External Threats to Parks* was distributed to all areas in the Western Region, including Grand Canyon National Park. The report was prepared and submitted to the Chairman, Subcommittee on National Parks, Forests, and Public Lands. This GAO report recalls a 1987 report which stated that very limited progress was made in documenting and mitigating threats to parks. Further, the document reveals that to their dismay, the National Park Service *still* does not know the extent to which the resources under its stewardship are being threatened because it does not maintain an inventory of the number, types and sources of threats or the damage caused. *"Without such information,"* the report states, *"management at (NPS) headquarters does not know the extent to which external sources are threatening the park resources, the amount of damage that has already occurred or is expected in the future, or the mitigation actions that are needed"*.

This GAO summary also recalls the 1980 State of the Parks report by the National Park Service, which identified threats throughout the system. What was not recalled, however, are the recommendations at the end of this document: a plan for successful resources management. Very few of these recommendations were followed, either. Some highlights of this advice are recounted here:

"Resources Management is often of lower priority in the competition for available funds for the following reasons:

(1) The "crisis" level resource problem is usually slow in developing and can handily be "put off";

(2) Visitor needs are visible needs... "now," and

(3) Health and safety deficiencies supersede resources deficiencies in the minds of managers

The report further states that, *"Funding for natural and cultural resources management should be considered on its own merits and not in competition with other management concerns.....The identified threats to the resources and needed monitoring/research/ and/or corrective actions are probably grossly understated because the Service does not have the numbers of qualified personnel in the field to recognize threats and needs...."*

This study is highlighted here, in this Resource Management Plan, to reiterate the importance of adequate funding and staffing of Grand Canyon's Resource Management Division. Today, all 1.2 million acres of Grand Canyon has a total of one wildlife resource specialist, two vegetation specialists, one hydrologist, one physical resource scientists, one outdoor recreation planner, and two archaeologists. Their base budget for 1994 was \$656,200. There are some fluctuations in available seasonal help, and occasional special and/or cyclic funds have increased this figure (+ \$130,000 in 1994), however the numbers are still astoundingly low.

This Resource Management Plan will address what threats are known to these few specialists and concerns identified by participants in the 1994 RMP scoping session. The plan will attempt to outline a logical action plan to address those concerns. It is the hope of this plan that these action plans

will be funded and staffed so that outlined resource management goals come to fruition.

PURPOSE OF THIS RESOURCE MANAGEMENT PLAN

Definition: The Resource Management Plan (RMP) is, first and foremost, a summary and analysis of the park's resource information base and a plan for the preservation and management of the park resources. This document will verify resource issues and data deficiencies, laying out a logical, long-term resource management course. The RMP is a mechanism to integrate divisional responsibilities in achieving resource preservation and management objectives. It is particularly important in clarifying the interface between natural and cultural resources management and applications of social sciences. It is used to coordinate actions of other park plans and as a springboard to develop detailed resource management action plans. Finally, the RMP is Grand Canyon's primary source for information used in preparing budget requests to seek and acquire funding for resource management projects and programs. (RMP Draft Guidelines, 1994)

Goal of the RMP: Comprehensive Resource Preservation and Management: Preservation of natural and cultural resources within Grand Canyon National Park requires a long term perspective and a commitment towards comprehensive resources management. It is the fundamental requirement for its continued use and enjoyment by park visitors as an unimpaired natural area of the National Park System. The foundation for resources preservation is contained within the legislative history of the park, management objectives and attendant planning documents. The strategy for the long-range management of Grand Canyon's natural and cultural resources is contained within this document.

The Colorado Plateau Region: The natural resources management proposals for Grand Canyon National Park are guided by the fundamental tenet of maintaining and perpetuating ecosystems and natural processes rather than simply protecting and preserving individual features or favored species. The ecosystems within Grand Canyon National Park are part of the greater ecosystem of the Colorado Plateau. This is, and must remain, a distinguishing aspect of resources management so that the park remains a place where natural forces remain unimpaired and the complete interrelationship of the ecosystem can prevail.

The plan also recognizes that historical and archeological resources of Grand Canyon are a significant part of the cultural geography of the Colorado Plateau. They require active management programs. In keeping with the National Park Service Management Policies Handbook, the plan includes cultural resources management proposals which form the basis of a comprehensive, long-range program for the preservation of historic structures and landscapes, archeological sites and artifacts.

Because of the cooperative situation in the Colorado Plateau region, this plan is also directed to agency partners in cultural and natural resource protection in the region. Other land management agencies, universities, museums, professionals, cooperating organizations, docents and concerned citizens can use this plan. It also provides a forum and opportunity for mutual cooperation on resource management goals and strategies with Native Americans.

Objective of RMP: This document will identify, define and program specific inventory, monitoring, research, mitigation, maintenance, enforcement and interpretive activities that are currently in place or are

required to perpetuate natural and cultural processes at Grand Canyon National Park. It aims to achieve the park's purpose and objectives and to help regulate the use of the park. This plan draws upon appropriate legislation and National Park Service policies and guidelines, as well as on a knowledge of the resources of this park and its special needs.

What the plan will not do is provide a detailed treatise on the status and trend of the cultural and natural resources in the Grand Canyon. The complexity of the resources and issues requires a review that would be too long and cumbersome for the purposes of this plan. A brief analysis of significant issues and themes is included, however. Summaries of existing resource knowledge are contained in the various overviews listed in the appendix.

Applications: This RMP provides the basis for measuring resource management accomplishments against documented needs

and commitments. It sets priorities for park programs and provides a rationale for allocating funding and staff by the NPS Western Regional Office and Washington Offices.

This document is also intended as a general guide for local **universities and colleges**. It will direct student and volunteer **researchers** toward projects that enhance park purposes and address priority management issues.

This resource management plan may also provide direction for **organizations** to recognize achievable projects that may be accomplished through **donations or volunteers**. Such organizations and friends groups may follow the rationale for various action plans through Chapters which describe management objectives and highlight pressing management issues. Project statements range from those which are research oriented, those that are recurring and on-going, those that are one-time projects and those that are cyclical in maintaining resource integrity.

GRAND CANYON NATIONAL PARK

LOCATION

Grand Canyon National Park lies on the Colorado Plateau in northwestern Arizona. The area is a vast, semiarid land of raised plateaus and structural basins typical of the southwestern United States. Drainage systems are deeply cut, forming numerous steep-walled canyons. The higher elevations of the plateau are forested; the lower elevations are a series of desert basins.

On the Colorado Plateau approximately half of the land is federally owned, administered

by the Bureau of Land Management, United States Forest Service and National Park Service. Most of the remaining land is held in trust for Native American tribes.

Grand Canyon National Park, encompassing 1,218,376 acres, is the prime regional resource. The park is bounded on the north by Kaibab National Forest and the Arizona Strip District of the Bureau of Land Management, on the east by the Navajo Reservation, on the south by Kaibab National Forest and Hualapai and Havasupai Reservations, and on the west by the upper reaches of Lake Mead National Recreation Area. The park is located entirely within Arizona, in Mohave and Coconino Counties, and is in Congressional District Number 3.

REGIONAL MAP

BOUNDARY MAP

PURPOSE AND SIGNIFICANCE

Park purposes have been drafted by the General Management Planning team as they prepare a new General Management Plan for the park:

- * *Preserve and protect the natural and cultural resources and ecological processes of Grand Canyon, and its scenic, aesthetic, and scientific values, as a place of national and world-wide importance.*
- * *Provide opportunities for visitors to experience and understand the environmental interrelationships, resources, and values of Grand Canyon without impairing the resources.*

World Heritage Site

As a world heritage site, the Grand Canyon is recognized as a place of universal value, containing superlative natural and cultural features that should be preserved as part of the heritage of all people in the world. The Grand Canyon is unusual in meeting both natural and cultural resource criteria for designation as a world heritage site.

Natural Resources and Natural Ecosystem Processes

Well known for its geologic significance, the Grand Canyon offers an excellent geologic record of three of the four eras of geological time. It is one of the most studied landscape and geologic records anywhere in the world. The fossil record is rich and diverse as well. The canyon also contains a great diversity of geologic features and rock types. Numerous caves in the park contain extensive and significant geological, paleontological, archeological and biological resources. As stated in the establishing legislation, the Grand Canyon is the "greatest eroded canyon

in the United States." It is considered one of the finest examples in the world of arid-land erosion. The Grand Canyon is neither the world's longest nor deepest canyon, but its volume is immense, averaging 4,000 feet deep for its entire length of 277 miles, 6,000 feet deep at its deepest point, and 15 miles wide at its widest. The significance of the Grand Canyon, however, is not limited to geology.

Grand Canyon National Park incorporates 277 miles of the Colorado River; with 160 recognized rapids within the park boundaries, the Colorado is one of the longest and most challenging recreational white water rivers in the world.

The great biological diversity of the park includes examples of five of the seven life zones and three of the four deserts in North America. In going from the rim to the river, one encounters five life zones—Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian—equivalent in climatic zones to traveling from Mexico to Canada.

The park serves as an ecological refuge, with relatively undisturbed remnants of dwindling ecosystems (such as boreal forest and desert riparian communities), numerous rare, endemic or specially protected (threatened/endangered) plant and animal species. Over 1,500 plant species, 287 bird species, 88 species of mammals, 58 reptile and amphibian species, and 26 native species of fish are found in the park.

Natural Resources Research

As a scientific resource it is a Mecca for geologists, geographers and biologists throughout the world. Six research natural areas have been designated in the park (8,845 acres total) to provide opportunities for nondestructive research in areas relatively uninfluenced by humans. A national natural landmark occurs partially within the park,

which encourages recognition and protection of the ponderosa pine habitat of the Kaibab Squirrel—a classic example of the process of evolution through geographic isolation. The park serves as a natural gene pool, because of its biological diversity and unique conditions.

Cultural Resources

Over 4,000 years of human occupation have resulted in a rich and dynamic cultural geographical history which is still evident:

- Today, eight separate Indian Tribes have close cultural and sacred ties to the Grand Canyon, with some considering the canyon their original homeland and place of origin. Grand Canyon contains more than 2,700 known archeological sites with artifacts indicating 3,000 to 4,000 years of human habitation. A recent finding suggests human use of the canyon as much as 10,000 years ago. Less than five percent of the park has been systematically surveyed.

- Anglo inhabitation of the area has brought to the region the heritage of the great western frontier and tourism. The park's historic properties include 120 buildings listed as National Landmarks, 136 listed on the National Register of Historic Places and an additional 229 properties on the List of Classified Structures.

Scenic Qualities and Values

The Grand Canyon has internationally recognized scenic vistas, qualities and values. With ever-changing and colorful scenery of enormous proportions, it is widely considered one of the world's most beautiful natural areas. The great diversity of scenery includes forests, deserts, canyons, plains, plateaus,

volcanic features, streams and waterfalls. The Grand Canyon's excellent air quality is extremely important to its scenic quality (i.e., visibility, colors and details). The night sky viewing is also excellent.

Recreational and Educational Opportunities

For the general visitor it is a place of tremendous natural, scenic and historic interest. For all who visit, it is a place of beauty. For those who seek solitude, it is a place of accessible peace and natural quiet. All of the natural, cultural, scenic and natural quiet qualities of the Grand Canyon, coupled with the canyon's vast size and natural quiet, give rise to inspirational and spiritual values and a sense of timelessness.

As an excellent educational example, Grand Canyon National Park contains 78% of the themes listed in the National Park System Plan in the Colorado Plateau natural region. The Grand Canyon contains significant examples of: plains, plateaus and mesas; work of volcanism and sculpture of the land; river systems and lakes; geologic history; boreal forest; and dry coniferous forest and woodland. The cultural resources also provide an important lesson in the rich and dynamic heritage and history of the Colorado Plateau. Many examples of the cultural and natural history of the park are available for research and study in the park's museum collection.

A wide diversity of resource-based recreational opportunities and support services help visitors experience, enjoy and appreciate the park. The vast majority of the park provides opportunities for wilderness experiences. Hundreds of miles of trails and routes provide access to park resources and diverse recreational opportunities and experiences. Three inner canyon trails are

designated national recreation trails as part of the national trails system. The Colorado River, as it flows through the park, provides opportunities for one of the world's most premier river experiences, including one of the world's longest stretch of navigable white water.

Potential Designations

Over 1 million acres in the park meet the criteria for wilderness designation as part of

the national wilderness preservation system. If combined with over 400,000 additional acres of proposed or designated wilderness contiguous to the park boundary, this area could become one of the largest, primarily desert wilderness areas in the United States. The Colorado River and most of its tributaries in the park meet the criteria for wild river designation as part of the **National Wild and Scenic Rivers System**.

LEGISLATION AFFECTING THE NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

Public Law 93-620, the Grand Canyon Enlargement Act, summarizes the park's significance, stating that Grand Canyon National Park is a "natural feature of national and international significance." The Act established the 1,215,735-acre Grand Canyon National Park from a mixture of state and federal lands which included: the former Grand Canyon National Park, Grand Canyon National Monument, Marble Canyon National Monuments, and portions of Lake Mead National Recreation Area, U.S. Forest Service, Bureau of Land Management, and Bureau of Indian Affairs lands.

Public Law 93-620 also authorizes the Secretary of the Interior to submit to the Federal Aviation Administration, the Environmental Protection Agency, or other responsible agencies his recommendations for regulations concerning the use of aircraft in Grand Canyon National Park, if aircraft are threatening the safety of the public, the visitor's experience, or the park's natural quiet.

The law also authorized grazing on approximately 288,000 acres of park land. This included 193,000 acres on the Sanup Plateau where grazing would be permitted for a maximum of 10 years and 95,000 acres adjacent to the Havasupai Reservation open for exclusive grazing use by the Havasupai Indians.

Additional legislation influencing resources management activities in the park includes the National Park Service Organic Act of 1916, the Archeological Resources Protection Act of 1979, Antiquities Act of 1906, National Environmental Policy Act of 1969, the American Indians Religious Freedom Act of

1978, the National Historic Preservation Act of 1966 and as amended in 1980, the executive Order 11593, Executive Order 11987, the Wilderness Act of 1964, the Federal Water Pollution Control Act as Amended 1977, the Endangered Species Act of 1973, and the Clean Air Act Amendments of 1977, Native American Graves Protection and Repatriation Act of 1990, and the Grand Canyon Protection Act of 1992.

Grand Canyon's significance was further recognized in October 1979 with designation as a World Heritage Site. The high percentage of foreign visitation clearly demonstrates the park's international popularity.

Grand Canyon National Park was first set aside as a "Public park for the benefit and enjoyment of the people" on February 26, 1919 (40 Stat 1175, Grand Canyon National Park Establishment Act).

LIST OF LEGISLATION AFFECTING GRAND CANYON

1. Executive Orders (unnumbered) (June 8, 1880; November 23, 1880; March 31, 1882) Yavai Suppai Indian reservation was withdrawn from sale and settlement.
2. Presidential Proclamation Number 15 (February 20, 1893) Grand Canyon Forest Reserve established and lands exempted from all public land laws except those involving mineral claims.
3. Chapter 3593, An Act for the protection of wild animals in the Grand Canyon Forest Reserve (June 29, 1906) Established Grand Canyon Game Preserve, wherein hunting, trapping, killing and capturing game animals on the Grand Canyon Forest Reserve were prohibited.
4. Act for the Preservation of American Antiquities, June 8, 1906 (16 USC 431-433) Authorizes the President to declare national monuments to protect sites and objects; authorizes Federal departments to grant permits for survey and excavation and to enforce protection of archeological sites and objects under their jurisdiction; and requires that materials excavated be permanently preserved in public museums.
5. Presidential Proclamation Number 794 (January 11, 1908) Grand Canyon National Monument was established for protection of this "object of unusual scientific interest". Grand Canyon Forest Reserve lands were combined with other federal lands to form the monument. All monument lands were withdrawn from any new claims. Destruction and appropriation of monument features was prohibited.
6. The Organic Act of 1916 directs the National Park Service (NPS) to regulate park use and promote enjoyment of park lands in a manner consistent with the conservation of park scenery, natural and historic objects, and wildlife. In order to fulfill these mandates, all planning activities must insure that public use facilities do not disrupt or damage resources to a degree whereby their ability to serve future visitors is reduced, that appropriate nondestructive public use and enjoyment of resources is made possible, and that natural and cultural park resources are preserved.
7. 40 Stat 1175, Grand Canyon National Park Establishment Act (February 26, 1919) Converted Grand Canyon National Monument to Grand Canyon National Park, established as a "public park for the benefit and enjoyment of the people." Concessions are to be competitively bid. Havasupai reservation rights reaffirmed. Secretary of Interior permitted to establish rights-of-way within the park for reclamation projects, irrigation projects, and railroads, wherever consistent with the primary purposes of the park. Mineral exploration and development within the park was permitted. Provisions of Grand Canyon Game Reserve were revoked on park lands.
8. 43 Stat 423, Department of the Interior Appropriations Bill (June 5, 1924) Secretary authorized to purchase the Bright Angel Toll Road and construct a south entrance road.

9. 44 Stat 497 (May 10, 1926) Exchange of patented lands within the park for park land is authorized.
10. 44 Stat 1238, An Act to revise the boundary of Grand Canyon National Park (February 25, 1927) Grand Canyon National Park enlarged and exempted from the 1920 Federal Power Act.
11. 46 Stat 1043 (January 26, 1931) Grand Canyon closed to mineral entry.
12. Presidential Proclamation Number 2022 (December 22, 1932) Grand Canyon National Monument (under Antiquity Act authority) for protection of portions of the canyon below the national park which are of unusual scientific interest. Destruction or removal of any monument features is prohibited.
13. Historic Sites Act of 1935 (16 USC 461-467) Authorizes the Secretary of the Interior through the National Park Service to preserve and maintain objects of national historical or archeological significance and to "establish and maintain museums in connection therewith."
14. Presidential Proclamation Number 2393 (April 4, 1940) Certain lands were excluded from Grand Canyon National Monument because they were not necessary for proper care and management of objects of scientific interest situated in the monument.
15. Museum Properties Management Act of 1955 (16 USC, Sect. 18 [f]) Authorizes the Secretary of the Interior through the National Park Service to acquire collections through donation and purchase and to loan and exchange collections.
16. 76 Stat 79, An Act to provide for the acquisition of a patented mining claim on the South Rim of the Grand Canyon (May 28, 1962) Permitted Secretary to acquire Orphan Mine which was found to be strategically located to adversely affect visitor enjoyment of the park. Mineral rights were reserved to the owner for 25 years at which time they would revert to the Federal government
17. The Wilderness Act of 1964 requires all Federal land-managing agencies to examine their resources for possible wilderness classification. Grand Canyon national Park lands have been studied and evaluated for placement in the National Wilderness Preservation System. A draft proposal and draft environmental impact statement (DES 76-28) were prepared and circulated to the public in 1976. Based on public input received, a final proposal was developed and submitted to the NPS Washington Office in 1980.
18. Presidential Proclamation Number 3889 (January 21, 1969) Established Marble Canyon National Monument to permanently protect "unusual geologic and paleontologic features and objects and other scientific and natural values."
19. Public Law 91-383, To improve the Administration of the National Park System (August 18, 1970) Section 3(c) authorized the Secretary to enter into contracts to sell or lease to persons, States, or their political subdivisions services, resources, or water from a national

park if (1) they provide services or accommodations in the immediate vicinity of the park, and (2) there are no reasonable alternatives to provide these services without these resources or water. The House Report on this bill (H.R.91-1265) suggests that National Park Service should provide reports to Congress prior to entering into any legally or morally binding commitments.

20. Section 208 of the Federal Water Pollution Control Act as amended in 1972 dictates that Federal areas are subject to State and local water quality regulations. Thus Grand Canyon National Park must meet Arizona State Water Quality Standards.
21. The Endangered Species Act of 1973 requires all Federal Agencies to consult with the Secretary of the Interior on all projects and programs having potential impact on endangered flora and fauna. The legislation further requires Federal Agencies to take "...such action necessary to ensure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species which is determined...to be critical..."
22. Executive Order 11987 states that "executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration and shall encourage States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States."
23. Public Law 93-620, Grand Canyon National Park Enlargement Act (January 3, 1975) Combined Marble Canyon and Grand Canyon National Monuments with existing Grand Canyon National Park. Purpose was to "further protect the outstanding scenic natural and scientific values of the Grand Canyon." Congress recognized that the entire Grand Canyon from the Paria to Grand Wash Cliffs, including side canyons is a natural feature of national and international significance. Congress provided for "further protection and interpretation of the Grand Canyon in accord with its true significance." Studies of Tuckup Point, Jensen Tank, and Slide Mountain were required in order to determine their suitability as park lands. Authority to acquire private lands was vested in the Secretary, but lands owned by the State of Arizona or any political subdivision thereof could only be acquired through donation or exchange. Cooperative agreements with other federal, state, and local public departments or Indian Tribes are authorized in order to provide uniform interpretation of the park. Continuation of grazing rights for either 10 years or the life of the leaseholder was provided.

The Secretary was empowered to make recommendations to control aircraft traffic to protect the park's natural quiet. The Secretary is authorized to permit use of former Lake Mead lands (now within Grand Canyon) for the development and maintenance of reclamation projects. A total of 95,300 acres were withdrawn from Grand Canyon to be held in trust by the United States for Havasupai tribe traditional use purposes (gathering/hunting native wild plants or animals, medicinal gathering, grazing, burials, etc.). However, no uses were to be made of this land which will impact the existing scenic and

natural values. Further, the Secretary is responsible for conservation programs for fire protection, grazing management and erosion control, etc., on these lands. Elimination of Supai Camp was provided for.

24. Public Law 94-31, To Amend the Grand Canyon Enlargement Act (June 10, 1975) Provided the Secretary 2 years to make a recommendation as to the suitability or nonsuitability of any portion of Grand Canyon National Park as wilderness.
25. The Clean Air Act Amendments of 1977 designated Grand Canyon National Park as a Federal Class I area. This means that visibility within the park is not to be impaired by any manmade source, and methods must be devised to monitor such visibility.
26. Public Law 95-589, Title XII (November 3, 1978) Authorizes the Secretary, without derogation of any United States water rights, to sell Grand Canyon water to Tusayan customers upon his determination that such sale is not detrimental to the resources of Grand Canyon or its visitors.
27. Executive Order 11593 directs Federal agencies to survey all properties under their administration which might qualify for listing in the National Register of Historic Places and to nominate them to the register.
28. The American Indians Religious Freedom Act of 1978 (public Law 95-341) mandates that Federal agencies "...protect and preserve American Indian religious cultural rights and practices." Each Federal agency must undertake consultation on its missions, statutes, regulations, and policies with traditional native American religious leaders.
29. The Archeological Resources Protection Act of 1979 (Public Law 96-95) superseded the Antiquities Act of 1906. This act established (1) that archeological resources on public and Indian lands are protected, (2) permit requirements for resource excavation or removal, and (3) civil and criminal penalties for illegal removal of these resources.
30. Hatch Amendment Number 1754 to the Fiscal Year 1981 Department of the Interior Appropriations Bill (Congressional Record, November 14, 1980) None of the funds appropriated in this act shall be used for the implementation of any management plan for the Colorado River within the Grand Canyon National Park which reduces the number of user days or passenger launches for commercial motorized watercraft excursions below 1978 levels for the preferred use period.
31. National Parks Overflights Act of 1987 Regarding aircraft overflights in Grand Canyon and other national parks. The Secretary of the Interior was charged to submit recommendations to the FAA that would "provide for substantial restoration of the natural quiet and experience of the park and protection of public health and safety from adverse effects associated with aircraft overflights."
32. The National Park Service Management Policies, 1988 regarding Genetic Resources states, "...The NPS will strive to protect the full range of genetic types (genotypes) native to plant

and animal populations in the parks by perpetuating natural evolutionary processes and minimizing human interference with evolving genetic diversity. This means that the introduction of native plants and animals will be accomplished using organisms taken from populations as closely related genetically and ecologically as possible to the park populations, preferably from similar habitats in adjacent or local areas, except where the management goal is to increase the variability of the park gene pool to mitigate past, human induced loss of genetic variability.

33. Grand Canyon Protection Act of 1992: regarding the operation of the Glen Canyon Dam. This act states that the Secretary shall operate the Glen Canyon Dam....in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use.
34. The National Historic Preservation Act as amended in 1992 requires all Federal agencies to inform the Advisory Council on Historic Preservation of the effect of any undertaking on any district, site, building, structure, or object which is eligible for, or included in, the National Register of Historic Places and to afford the Council a reasonable opportunity to comment.

INTERRELATIONSHIP WITH OTHER PROJECTS AND PLANS

General Management Plan

Resources Management Plan	Visitor Use Plan	General Development Plan
Water Mgt Plan	Backcountry Mgt. Plan	Development Concept Plan
Veg Mgt Plan	Interpretive Prospectus	Preliminary Design
Fire Mgt. Plan	Park Safety Plan	Maintenance & Support Operational Guide
Wilderness Study	Transportation Plan	Structural Fire Mgt. Plan
Historic Resource Study	Wayside Exhibit Plan	Sign Plan
Collections Mgt. Plan	Search & Rescue Plan	Trails Plan
etc.	etc.	etc.

NPS - PLANNING PROCESS

MANAGEMENT GOALS AND OBJECTIVES

Management of natural and cultural resources at Grand Canyon National Park is based on management objectives which provide the park manager with a context for evaluation of preservation and use. These objectives are based on an integration of Grand Canyon National Park mandates and NPS policy. They represent a combination of management objectives from the 1987 Resource Management Plan, park's Statement for Management (1993) and draft General Management Plan (1993). This list only includes those management objectives which relate directly to the management of natural and cultural resources.

I. VISION STATEMENT

Overall Objective: Manage Grand Canyon National Park as a preeminent example of National Park Service resources and visitor management within the National Park System, according to the park's enabling legislation and 1975 Enlargement Act.

- a. Manage the park to preserve its integrity as a World Heritage Site with natural, cultural and scenic resources of national and international significance.
- b. Inventory, monitor and maintain data on park natural and cultural resources and values and utilize this data in the most effective ways possible to facilitate park management decisions to better preserve the park. This would include developing a park database of cultural resources such as historic resource studies, administrative history, oral history and archeological overviews and

assessments.

- c. Support research programs pertaining to natural and cultural resources and to social sciences consistent with the park's resource protection and visitor services mission.
- d. Manage the park as part of the greater Colorado Plateau, recognizing the interrelationships between resources management with our park neighbors.
- e. Develop a General Management Plan that will guide efforts at Grand Canyon National Park to, "Conserve the scenery and the natural and historic objects and the wild life therein and provide for the enjoyment of the same in such manner as will leave them unimpaired," into the twenty-first century. It should emphasize efforts at resources conservation and incorporate all park values above and below the rim. (Currently underway)
- f. Manage areas meeting the criteria for wilderness as wilderness. Actively pursue the designation of these lands as part of the National Wilderness Preservation System.

II. NATURAL RESOURCES MANAGEMENT

Overall Objective: Manage, maintain, preserve and perpetuate the natural resources and natural ecological processes of Grand Canyon National Park.

- a. Perpetuate native plant and animal life

- recognizing their essential role in the natural ecosystem.
- b. Protect threatened and endangered plants and animals from adverse impacts of human origin.
 - c. Eliminate non-native plant and animal species wherever possible to ensure the perpetuation of a natural ecosystem. Preserve and protect the genetic integrity and species composition within the park, consistent with natural ecosystem processes.
 - d. Manage "naturalized ecosystems" (such as the Colorado River) by ensuring the preservation of natural components and enhancing their preservation through active management of non-native components and processes.
 - e. Eliminate existing and prohibit new activities inconsistent with protection of the natural ecosystem, except in the park's developed areas as approved in the park's management plan, including but not limited to grazing, mining and hazardous tree management.
 - f. Protect and conserve sources and quality of existing natural water resources and where contamination has occurred, restore water quality to its original state. Preserve natural spring and stream flows and water quality. Keep water withdrawals to the minimum necessary to meet park purposes. Work to minimize impacts on natural water systems and understand flood potential.
 - g. Preserve the air quality and protect it from within-park as well as external degradation. Work toward continued protection of the Class I airshed at Grand Canyon National Park.
 - h. Protect the natural quiet and control activities causing excessive or unnecessary noise in, over and adjacent to the park which detract from visitors' enjoyment of natural park values or adversely affect park resources.
 - i. Manipulate terrain and vegetative cover in order to restore natural conditions on lands altered and used by humans.
 - j. Ensure population of native insects and the incidence of native diseases function unimpeded except where control is necessary to stop the spread of epidemic populations to developed zones or onto adjacent non-park lands.
 - k. Reintroduce the natural role of fire in park ecosystems to the maximum extent possible.
 - l. Perpetuate the natural, geological, and ecological conditions and historic associations of the park's cave resources.
 - m. Clearly delineate and maintain park boundary to protect natural resources.

III. CULTURAL RESOURCES MANAGEMENT

Overall Objective: Preserve, manage and interpret park cultural resources (for example, archeological, ethnographic, architectural,

historic resources, trails and cultural landscapes) for the benefit of present and future generations.

- a. Protect the character and fabric of the many historic cultural resources in the park through preservation, restoration, register listing, adaptive use, and other appropriate means.
- b. Identify and evaluate all cultural properties within the park for inclusion on the national Register of Historic Places.
- c. Perpetuate unimpaired the park's prehistoric cultural resources, protecting them from vandalism or unauthorized excavation, collection, appropriation, or visitor use.
- d. Collect ethnographic data and develop an ethnohistory for the Havasupai, Hopi, Hualapai, Navajo, Southern Paiute, and Zuni in association with the Grand Canyon, as appropriate, to preserve, protect and interpret park resources and values important to diverse Native American cultures, including sacred, significant and traditional use areas.
- e. Maintain and protect an effective museum collection that is up-to-date, which reflects current preservation policies, and meets most information and research needs.
- f. Clearly delineate and maintain the park boundary to protect park resources and values.
- g. Maintain and enhance government-to-government relationships with Indian Tribes throughout the region who have ancestral interests in Grand

Canyon.

IV. WILDERNESS AND WILD RIVER MANAGEMENT

- a. Manage areas meeting the criteria for wilderness designation as wilderness. Actively pursue the designation of these lands as part of the National Wilderness Preservation System.
- b. Manage the Colorado River and its tributaries meeting the criteria for wild designation under the federal Wild and Scenic Rivers Act as a wild river. Actively pursue designation of these waters as part of the National Wild and Scenic Rivers System.

V. VISITOR USE MANAGEMENT

**Those management objectives which relate to resources management*

Overall Objective: Provide for park visitors the use and enjoyment of park resources which is compatible with protection goals.

- a. Manage visitor use to ensure that the resiliency of ecosystems and cultural resources is maintained.
- b. Permit access to all areas of the park consistent with resource protection objectives, visitor capabilities and carrying capacities and use limits.
- c. Offer a variety of recreational opportunities which are appropriate to the park's significance and which are sensitive to the range of visitor interest, physical capabilities and time and financial limitations, without damaging park resources.

- d. Strive to mitigate heavy South Rim summer visitation impacts on visitors and resources by working to integrate visitor information, traffic control, parking and alternative forms of transportation.
- e. Maintain the South Rim and Inner Canyon Corridor for heavy visitor use consistent with safety and environmental considerations.
- f. Encourage the continuation of the different visitor experience of the North Rim by assuring that services provided are appropriate to that smaller and lesser used area.
- g. Restrict mechanized access below the rims to emergency and critical management use.

VI. INTERPRETIVE SERVICES

**Those management objectives which relate to resources management*

- a. Strive to instill in visitors an understanding of and appreciation for park values and resources.
- b. Present major park management and resource protection challenges and management strategies as an integral part of interpretive materials.
- c. Maximize opportunities for visitor enjoyment of interpretive services, facilities and resources consistent with other park management objectives.
- d. Maintain an effective library that is up-to-date and reflects current information and research needs.

VII. PARK OPERATIONS MANAGEMENT

**Those management objectives which relate to resources management*

Overall Objective: Perpetuate an integrated team organization that maximizes inter-divisional communications while promoting individual initiative. Use a interdisciplinary approach in managing park natural and cultural resources.

- a. Maintain a quality visitor experience through the protection of persons, property and resources and the reduction of crime.
- b. Rehabilitate or maintain all facilities at a level that meets all local, state and federal codes and regulations for health and safety. Meet standards for historic properties preservation.
- c. Use reclaimed water to supplement fresh water supply from Roaring Springs where appropriate for human use and to the maximum extent feasible for non-human use.
- d. Perpetuate management efficiency through the efficient, effective and appropriate use of available public funding sources, private-sector support, fees, low- or no-cost labor, productivity enrichment strategies, concessioners, and contracts consistent with the mission of the National Park Service.

VIII. FACILITIES AND SERVICES MANAGEMENT

**Those management objectives which relate to resources management*

Overall Objective: Consistent with the park's purpose, strive to make Grand Canyon a model of excellence in sustainable design and management through such means as energy efficiency/conservation, compatibility with historic setting and architecture, recycling, accessibility, and the use of alternative energy sources.

- a. Provide facilities and services to accommodate visitor needs which are compatible with resource protection goals and carrying capacity limits.
- b. Consider out-of-park locations when planning facilities.
- c. Maximize appropriate use of existing visitor facilities and use vacated buildings to accommodate necessary expansion of visitor facilities. Encourage appropriate adaptive reuse of historic structures, while preserving historic integrity and cultural landscapes. Build new facilities or expand existing facilities only when a clearly demonstrated, continuing need exists.
- d. Minimize or mitigate environmental impact if additional facilities are needed.
- e. Preserve the scenic resources of the park. Where human influences detract from the scenery, improve visual quality throughout the park.
- f. Provide accessible, attractive and reasonable alternatives to automobile transportation.

IX. CONCESSIONS MANAGEMENT

**Those management objectives which relate to resources management*

- a. Maintain, preserve, and perpetuate an aesthetic setting for commercial services and community support services.
- b. Perpetuate the use of historic structures and facilities, consistent with their significance, for commercial purposes.
- c. Limit commercial development and services to that necessary and appropriate for public use and enjoyment of the park and within optimum carrying capacities and resource capabilities.

X. REGIONAL PLANNING AND COOPERATION

**Those management objectives which relate to resources management*

Overall Objective: As part of the Colorado Plateau, cooperate with all federal, state and local agencies, Indian tribes and private interest in the development of planning, development and management of the greater eco-region.

- a. Manage resources within the ecosystem, transcending political boundaries and jurisdictions.
- b. Understand, assess and consider the effects of park decisions outside the park as well as inside.
- c. Understand, assess and consider the cultures that have historically and are

currently living within the Colorado Plateau, with respect to the context for Grand Canyon.

- d. Work cooperatively to assist local American Indian tribes in the planning, development and management of tribal lands for recreational use, resource protection and traditional uses.
- e. Encourage the appropriate and orderly development of visitor use facilities outside park boundaries.
- f. Carry the National Park Service concern for the environment beyond the boundaries of Grand Canyon, to include the protection of park resources from external influences.
- g. Work with the park's cooperating association to provide both an active partner in assisting park educational programs and a sound business operation that will assure the association's continued success.
- h. Promote the most efficient use of government funds and services by developing formal agreements with adjacent land management agencies to meet wildland fire suppression, emergency medical services, search and rescue, law enforcement, river recreational use management, and other mutual needs.
- i. Continue active role in evaluation of Glen Canyon Dam Operations as a cooperating agency and exercising our management role and advocacy for park resources and values.

NPS PLANNING PROCESS

The way the National Park Service fulfills management objectives, such as those presented above, is to develop planning studies and documents which outline the most comprehensive and up-to-date strategies. The NPS - Planning Process Flow Chart illustrated earlier in this chapter shows the step-by-step process for outlining these strategies through appropriate plans. Note how the Resources Management Plan fits within this overall scheme.

LAND MANAGEMENT ZONES

Management of natural and cultural environments in a National Park System unit is based on management zones identified by the park General Management Plan and Statement for Management, but is derived from the following classification in NPS Management Policies (1988 4:1-2):

Natural Zones: The primary objective in natural zones is the protection of natural resources...Natural resources will be managed with a concern for fundamental ecological processes as well as for individual species and features...Managers and resource specialists...will try to maintain all the components and processes of natural evolving park ecosystems, including the natural abundance, diversity and ecological integrity of the plants and animals (p.4:1). Subzones include:

- * Wilderness
- * Potential Wilderness

Cultural Zones: The primary objective in cultural zones is to preserve and foster appreciation of the cultural resources. Where compatible with cultural resource objectives, the policies for natural zones will be followed. Subzones include:

- * Archeological District(s) Subzone
- * Historical District(s) Subzone
- * Native American Traditional Access Subzone

Park Development Zones: These are managed for intensive visitor use. Visitor facilities such as walkways, buildings and other management facilities occupy much of the zone. The natural aspects of the land within these zones is altered.

Special Use Zones: Where other public/private entity has jurisdiction within the park.

MAP SHOWING ZONING

Grand Canyon National Park has four land classification zones:

	Acreage	Percent
Development Zone	2,418	0.2
Historic Zone	298	0.0
Special Use Zone	95,300	7.8
Natural Zone	1,117,718	92.0
Total	1,215,735	100.0

The development zone is comprised of four distinct areas within the park: South Rim Village Area (2,200 acres), Desert View (50 acres), North Rim Developed Area (150 acres) and Phantom Ranch (18 acres).

The historic zone is comprised of four National Register districts on the North and South Rims. There are three districts on the North Rim: the Bright Angel Lodge District (73.05 acres), National Park Service Headquarters District (2.2 acres), and the North Rim Inn District (77 acres). The South Rim Village Historic District (73.5 acres) extends along the rim from the Bright Angel Lodge to the Verkamp's Store. The Grandview Historic District (91 acres) is located just below the Grandview overlook on Horseshoe Mesa.

The special use zone includes the 95,300 acre Havasupai Use Land.

The balance of the park (1,117,718 acres) is classified as a natural zone. Over one million acres are proposed wilderness areas.

NEPA & NHPA COMPLIANCE AND CONSULTATION

Environmental Compliance

Many management and development activities at Grand Canyon National Park have the potential to adversely affect the environment. These include road, trail, and various types of visitor facility construction, river operations, fire and wildlife management activities, and changes in regulations governing levels of visitor use. Compliance with NEPA, NHPA, and other environmental legislation is crucial (and a legal responsibility), as management is charged with maintenance and protection of essentially non-renewable resources and fragile natural ecosystem processes.

The Grand Canyon National Park Project and Environmental Compliance Guide describes the formal review process for projects that have the potential to impact the park's cultural and natural resources, aesthetic values, and visitor experience and safety. The process for preparation of environmental compliance documentation is detailed in the Guide, available through the Division of Professional Services, which should be

completed prior to initiating new projects.

Projects involving any of the following elements need environmental clearance;

- > ground or vegetation disturbance
- > historic sites, structures or districts
- > sites with potential archeological resources
- > floodplains or wetlands
- > threatened, endangered or sensitive species
- > wildlife disturbance or population impacts
- > changes in carrying capacities or user numbers
- > planning and development proposals
- > areas designated for Wild and Scenic River Status
- > prescribed burns
- > sites within significant scenic vistas or viewsheds.

Several parties involved with environmental compliance at Grand Canyon National Park help determine the proper clearance and whether the proposed project requires a categorical exclusion, environmental assessment (EA), or environmental impact statement (EIS). They are the project initiator and his/her Division Chief, Park Compliance Coordinator, Division of Professional Services, Chief and staff of Resources Management, and the Superintendent. When working with EA's and EIS's the Public Information Officer will be involved for public review, and the Regional Director will give final approval.

National Environmental Policy Act (NEPA)

Generally the Resources Management Plan is not the document through which environmental compliance is accomplished. Compliance (including requirements relating to NEPA, threatened and endangered species, floodplains and wetlands, air quality, and other areas) is usually accomplished on a case-

by-case basis as funding for a resource management activity becomes likely. Each action called for in the RMP project statement must be categorized as to whether environmental compliance has already been accomplished, is not required, or is required but has not been done and will be done before any irreversible and irretrievable actions have been taken.

Some actions called for in the Resource Management Plan are continuations of existing programs and have thus already been the subject of environmental or compliance actions. If not implemented under previous plans, actions called for in this plan are only proposals and thus not subject to environmental compliance actions under the National Environmental Policy Act (NEPA) of 1969 at this time. However, before any new actions proposed in this plan can be implemented, they must be subjected to separate and specific environmental compliance actions. (Please see appendix PPP for the Grand Canyon's compliance process)

NEPA requirements ensure that any proposal to implement a previously non-operative portion of this plan will include an opportunity for public comment and input.

National Historic Preservation Act (NHPA) Sections 110 and 106

For cultural landscapes or natural areas containing cultural resources, cultural resource compliance steps may be required. Section 110 is the preservation directive. Compliance with Section 106 of the National Historic Preservation Act of 1966 (as amended in 1992) is required for projects which may affect property potentially eligible for the National Register. The RMP as a whole may be reviewed or individual projects or groups of projects may be selected under

this act.

The cultural resources aspects of this plan will be developed in consultation with the Arizona State Historic Preservation Officer. This consultation will take form of a draft review of this document by appropriate state officials, as well as individual project consultation when necessary.

RELATIONSHIP OF OTHER PARK DIVISIONS TO RESOURCE MANAGEMENT PROGRAMS

Development and implementation of a comprehensive integrated resource management program at Grand Canyon National Park requires very close coordination between all park, regional, Denver Service Center and Washington Office divisions and their staff; as well as the staff of other jurisdictions within the Colorado Plateau region.

The components of an integrated resource management program include: management direction; planning and compliance; consultation and coordination; information gathering; research; inventory; restoration and rehabilitation; resource maintenance and operation; protection and law enforcement; mitigation; monitoring and evaluation; and education and interpretation.

Resource management projects and programs at the park level are implemented or facilitated by the divisions of Resources Management, Professional Services, Visitor Protection, Interpretation, Maintenance, Administration, Concessions Management, Public Affairs and the Superintendent's offices. All staff have some responsibility for managing the natural and cultural resources of the park to maintain, rehabilitate, protect, interpret and perpetuate their inherent

integrity.

The *Division of Visitor Services and Interpretation* has the primary responsibility for providing a comprehensive educational program for park visitors. This program includes the interpretation of natural and cultural resources; their description, their condition and protection. Currently, there is one full-time employees within the division of Interpretation who functions as a liaison between that division and Resources Management. She is made aware of various issues and become very knowledgeable in park resources as a result of this partnership. It is the goal of this plan that the Resources Management Division work more closely with Interpretation to ensure that the public are made aware of the value, significance, condition and protection of Grand Canyon's resources.

The *Visitor Protection Division*, for example, has the primary responsibility for resource protection and law enforcement; issuing backcountry permits and monitoring use; implementing the park's wildland and structural fire management programs; and in a few cases, monitoring the status and trend of natural and cultural resources. Currently, there is no formal interdivisional relationship between this division and Resources Management, except for archeological resource violations. It is the goal of this plan that Resources Management Staff work closely with Visitor Protection to ensure maximum natural and cultural resources protection, restoration and preservation.

The *Professional Services Division* has primary responsibility for park planning and design, safety and public health administration. Currently, this division works with Resources Management when compliance actions are necessary for a plan or design. It is the goal of the RMP that the Resource Management

staff work more closely with Professional Services staff to provide natural and cultural resources information for making informed decisions that protect, restore and preserve the park in their work.

The *Maintenance Division* has primary responsibility for site and structure maintenance, restoration and rehabilitation; mitigation of the impacts of recreational use and facility development. Currently, there is no historic preservation staff and site rehabilitation staff within this division. The trails crew performs multiple trails and site rehabilitation activities when funding is available, however, there is not sufficient base funding. It is the goal of the Resources Management Division staff to work closely with the park Maintenance staff to ensure maximum resource protection, restoration and preservation within the guidelines of this plan and according to appropriate resource compliance procedures.

The *Administration Division* staff have the primary responsibility for administrative support of the entire resource management program, including but not limited to; budget and fiscal affairs; personnel action and EEO; purchasing supplies and equipment; GSA vehicles; training; and computer support. Resources Management Division staff work closely with Administration staff to accomplish a variety of projects and programs that protect, restore and preserve the park's natural and cultural resources.

The Concessions Management Division

The *Public Affairs Office* has the primary responsibility for developing and maintaining contacts with the print and electronic media; preparing press releases about park resources and programs; and coordinating a variety of special media events. It is the goal of the Resources Management Staff to work closely

with the Public Affairs staff to provide them information about the park's resources and the park's natural and cultural resources management programs that protect, restore and preserve them.

The *Superintendent's Office* has the primary responsibility for oversight of the entire resource management program; setting natural and cultural resources program priorities; establishing deadlines for project completion; allocating the personnel and funding needed to successfully implement projects and programs; and evaluating the effectiveness and efficiency of resource programs. They represent the National Park Service and Grand Canyon National Park when dealing with issues in various political arenas. Resources management staff work closely with this Office to provide scientifically valid information for making informed decisions that protect, restore and preserve the park's natural, cultural and scenic resources.

COOPERATING ORGANIZATIONS

The Natural History Association: The Grand Canyon Natural History Association (GCNHA) operates as a not-for-profit publisher and retailer of interpretive and educational information for Grand Canyon National Park. They use primarily a book format but operate with openness to other media as appropriate. The association strives to educate the public on subjects dealing with natural and cultural history, as well as issues facing the environment. They offer classes through their "Field Institute" as a way to further the public's knowledge of the Grand Canyon.

The GCNHA has the educational, historical, scientific, and nonprofit purposes of assisting historical scientific, educational and interpretive activities of the NPS.

Grand Canyon Friends Group:

National Biological Survey: This group conducts research related to the Colorado Plateau ecosystem. Their major areas of focus for the Grand Canyon have been: Integrated-long-term Ecological Monitoring; design and monitoring of such projects involving Bald Eagles, Southwest Willow Flycatchers, Mexican Spotted Owls, avian neotropical migrant populations and endangered plants. The NBS also assists with the task of overseeing research contracts related to the Glen Canyon Environmental Studies (GCES) and has assisted with the scoping session for this resource management plan.

Northern Arizona University:

LAND USE AND TRENDS

Adjacent Land Uses

Grand Canyon National Park is entirely surrounded by other federal lands managed by a variety of agencies. To the west and to the northeast, the park is bounded by Lake Mead and Glen Canyon National Recreation Areas respectively. While these areas are managed for a greater variety of recreational activities than the park, uses along contiguous areas are not always compatible.

The major area of cooperation with *Glen Canyon National Recreation Area* is at Lees Ferry, where the confluence of the Paria and Colorado Rivers marks the boundary between the two NPS areas. From here, Grand Canyon river trips launch downstream while numerous fishermen launch upstream to fish within Glen Canyon. The Lees Ferry site is within the boundaries of Glen Canyon, but

both areas have on-site personnel. Glen Canyon is actively involved in the management of a trophy trout fishery below the dam and works with Arizona Fish and Game in stocking 50,000 exotic rainbow trout annually in the Colorado River. These fish have populated most sections of the post-dam altered aquatic environment of the Colorado River within the park.

The major area of cooperation between Grand Canyon and *Lake Mead National Recreation Area* staffs is Pearce Ferry and along the Grand Wash Cliffs. Pierce Ferry is a major takeout point for Colorado River trips.

North of the park is *Kaibab National Forest* and the *Bureau of Land Management's Arizona Strip District*. Both of these areas are managed under a multiple use concept. Within Kaibab National Forest, the major use is timber production. Thinning, slash burning, pest control and other forestry management techniques are regularly practiced. Grazing is also permitted on forest lands. These and other management practices require that Grand Canyon work with National Forest personnel to provide boundary protection from fire. The Kaibab National Forest is also designated as a Game Preserve, and is set aside for the protection of game animals and birds (16 USC 684-687).

On the Arizona Strip, use had been restricted to scattered grazing leases and limited recreational use until about 1980, when rich deposits of uranium ore began to be mined. There is currently one active mine operating in the vicinity of the park and two others under development. The closest is 3.5 miles from the park boundary. The potential impact of greatest concern to the park is introduction of radioactive wastes and/or mine water into watersheds leading into the park. Therefore, the possibility of discharge

into park watersheds is unknown. The actual magnitude of increased fugitive dust and other visitor-related impacts is directly related to uranium market conditions.

The other impact from the Arizona Strip which is already occurring is increased visitor use resulting from improved access to this area.

Trespass cattle grazing has occurred on Grand Canyon land, and the National Park Service has constructed fencing to ameliorate this problem (although this fence is not maintained). The inexact boundary location, inaccessibility to the area, and requirement for rock-drilling to set fence posts all make the fencing very expensive.

Approximately 400,000 acres of land in the Bureau of Land Management Arizona Strip District, including several units immediately adjacent to the park have recently received wilderness designation. This designation is compatible with Grand Canyon land use.

To the south, the park is bordered by the *Kaibab National Forest* and the *Hualapai* and *Havasupai Indian Reservations*. Issues of concern between the national forest and the park are similar to issues at the North Rim, with the exception of a pending land exchange between a private developer and the Forest Service.

A number of small inholdings within the USFS Tusayan Ranger District are being purchased by a developer to be exchanged for a more commercially viable parcel of land near the south entrance community of Tusayan. The developers propose lodging, retail, local resident housing and visitor attractions for the site. The development could significantly increase the number of employees living in the immediate area, impacting schools, law enforcement and other

infrastructure elements. They are proposing to accommodate this development by drilling a well, which may run as deep as ____ feet.

The Forest Service is also proposing additional campgrounds in the Tusayan Ranger District and a visitor facility in conjunction with the land exchange, both which could have impacts on the park, particularly in light of the ongoing General Management Plan process.

Native American Neighbors: Grand Canyon's Native American neighbors arrived at this homeland much before the first European Explorer ever ventured towards the rim to gaze at the geologic wonder. The relationship between the various Native American groups and the National Park Service has varied over the years, resulting in both positive and negative interactions. Today, as a result of recent leadership and expertise at the park, there is an effort to promote a partnership between these groups and the NPS. The General Management Plan has actively sought participation and input from each tribe, travelling to each reservation and meeting with representatives from each tribe. There is good communication between these groups and Grand Canyon National Park as a result of these efforts. The ethnography program description in this plan outlines important issues expressed at these meetings.

Interaction with the Havasupais is limited since most of their activities are in Havasu Canyon. Limited grazing does occur on rim lands. The park and Bureau of Indian Affairs have executed a cooperative agreement on the management of fires occurring along the common boundary.

To the east, the park is bounded by the *Navajo Reservation*. The boundary location is currently under dispute.

-map of adjacent lands and Colorado plateau-

Within Park Land Use

Virtually all lands within the park are federally owned:

Owner	Acreage	Percent
Navajo Nation	24,288.00	2.0
State of Arizona	11,860.00	1.0
Private	392.54	0.0
Federal (NPS)	1,179,194.10	97.0
Total	1,215,734.64	100.0

Lands in state and private ownership are undeveloped and not currently used for non-park purposes. Lands belonging to the Navajo Nation, however, are currently being used for grazing and other non-park subsistence uses.

State-owned lands consist of one tract, the Colorado River bottom. There is virtually no potential for development of these lands. Public Law 93-620 states that state lands can only be acquired by donation or exchange.

The highest priority acquisitions are the Hearst and Lee privately owned tracts. The Hearst property is the largest tract, consisting of 16 potential mining claims on 325.87 acres below the Grandview overlook and on the north bank of the Colorado River. The Lee property consists of 66.67 acres and is located on the north side of the Colorado River in the Toroweap Valley.

Lands on the east side of the Colorado River in the former Marble Canyon National Monument are included within the Navajo Reservation. Although these lands are currently being used for non-park purposes, acquisition by NPS in the near future is unlikely. Section 5(2) of Public Law 93-620 only allows for the transfer of lands held in

trust for Indian tribes to the United States upon approval of the Indian governing body.

VISITOR USE ANALYSIS

In 1919, the year Grand Canyon National Park was established, the park received 44,173 visitors. Since that time, although there have been up and down years, visitation has experienced a gradual increase. By 1956, the park was receiving over one million visitors per year. In 1969, the two million mark was topped. In 1976, the Bicentennial year, the park received 3,026,235 visitors and the number was over four million in 1991 (Appendix C).

The reason for increased visitation over the years has never been carefully studied. However, population growth, increased mobility, expanded communication/media networks, a growth in discretionary income and time and an increase in the number of available lodging units/campground spaces have all been contributing factors.

Seasonal use variations include 22 percent spring use, 48 percent summer use, 22 percent fall use, and 8 percent winter use. Surges in visitation occur during Easter week, Christmas week, and the first two weeks in

August. As with all parks, the spring and fall seasons are experiencing rapid growth.

In 1991 4,222,397 visitors entered the park (a 12 percent increase over 1990); backcountry permits were issued to users who spent 87,384 nights in the backcountry (although an exact figure is not known, the park estimates that approximately 800,000 visitors per year hike below the rims into Grand Canyon); river runners spent 163,262 user days on the Colorado River. Approximately 20,801 visitors rode mules into the canyon, while the air tour trade association estimates that 800,000 visitors enjoyed air tours.

A thorough analysis of existing data is needed to develop comprehensive visitor profiles and visitor use patterns for Grand Canyon National Park and to identify data gaps. A year long survey was conducted in 1991 for the General Management Plan. Existing data shows:

- * Almost 20 percent of the park's visitors venture below the rim.
- * A large percent of the park's visitors (about 30 percent) come from other countries.
- * The average length of stay is approximately 16 hours with a majority of the park visitors spending the night in lodges, motels, and campgrounds in and adjacent to the park.
- * Most visitors are not traveling as a part of an organized tour group but rather travel with two or three other people--usually members of the same family--and arrive via privately owned vehicles.
- * Most park visitors are well educated

and earn over \$20,000 annually.

- * Viewing the canyon from park overlooks, knowing that the park resources and values are being protected and experiencing the natural quiet are extremely important to a vast majority of park visitors.

Appendix BBBB contains visitation figures and graphs and information from previous visitor studies.

(insert graphic)

Chapter Two: Present Resource Status

Chapter Two:

PRESENT RESOURCE STATUS

Issues Overview

The Inaccessibility of Grand Canyon

Resources: The same vast, isolated and inaccessible nature of the canyon which makes it so rich and pristine in its resources also makes it virtually inaccessible to its resource managers. As was described earlier, the Grand Canyon's terrain is incredibly varied and unusual. On both rims, the topography is relatively flat. However, roads are few and access is very time consuming. The topography of the Inner Canyon is severe; steep talus slopes, precipitous cliffs, crumbly decomposing rock ledges and long declivitous side canyons make travel within the Inner Canyon limited and hazardous. Many areas are difficult, if not impossible, to enter without the aid of specialized equipment.

The handful of staff of the Resources Management Division has yet to explore some areas which are unreachable by vehicle, river raft and even by foot. Adjacent land uses, such as grazing, can and have encroached into some areas, trampling archeological sites, introducing exotic plant seeds and polluting natural springs with rare hanging gardens; all without notice.

It takes days and sometimes weeks to access many park areas; a luxury of time not available to such a small staff who also deal

with the pressures of increased visitation and development on the North and South Rims. The summer months, with inner canyon temperatures reaching 120 degrees F, are sometimes just as much as a deterrent as the winter snows, reaching as much as 10 feet on the North Rim.

As a World Heritage Site with over one million acres managed as wilderness, it is a sad reality that Grand Canyon's resources are not only inaccessible for management, they are, in some cases, anonymous to their managers.

ISSUES SUMMARY MATRIX

During the scoping session in February, 1994, many issues were raised and documented as concerns or threats to Grand Canyon's resources. These issues have been analyzed and summarized in terms of a matrix, so that any parallels or patterns of issues and threats may be identified. In this manner, those threats which affect more than one resource can be identified and given appropriate attention. The following matrix shows this analysis.

PROGRAM AREAS										
ISSUES OVERVIEW/ *	Vegetation	Wildlife	Water	Caves	Geology	Air	Paleon- tology	Recreation	Archeolog y & Ethno- graphy	Historic Resources ***
Must meet Laws, Mandates & Policies	N03 **	N02	N24	N24	N24	N24	N23	N24	C26	C26
Understand External Threats	N05, N16, N19, N06	N01, N02, N04, N05, N06, N17, N18, N19, N24, N16, N12, N11	N10, N11, N12, N13, N16	N24	N06, N10	N14, N16	N23	N15, N19	C17	C17
Manage from Colorado Plateau Perspective	N06, N19, N24	same as above	N24	N24	N06	N14	N23	N24	C04, C26	C04, C26
Understand Internal Threats (visitation, recreation & development)	N05, N06, N07, N17, N18, N19, N22	N01, N04, N05, N07, N17, N18, N19, N24	N12, N13	N18, N21	N06, N10	N14	N18, N23	N15, N18, N19, N22	C17, C18, C19	C13, C18, C19, C23, C24
Lack of Accessible Baseline Information	N17, N20	N20	N20	N20, N21	N06, N20, N21, N23	N14, N20	N20, N23	N18, N20, N22	C02, C14, C19	C03, C05, C06, C07, C08, C09, C11, C19
Lack of Management Program & Protection	N03, N07	N24	N24	N21	N21, N23, N24	N24	N23	N18, N19, N22	C13, C15, C18, C20, C21	N08, C06, C09, C12, C13, C15, C16, C17, C21
Lack of Staff & Funding	N24	N24	N24	N24	N24	N24	N24	N24	C24	C09, C15, C24
Threat to Life, Health & Safety	N24	N01, N24	N11, N24	N24	N10	N24	N24	N24	C21, C26	C20

Issues Overview

ISSUES OVERVIEW *	PROGRAM AREAS									
	Vegetation	Wildlife	Water	Caves	Geology	Air	Paleontology	Recreation	Archeology & Ethnography	Historic Resources ***
Lack of Education & Interpretation	N24	N24	N24	N24	N24	N24	N24	N18, N19, N22	C18, C25, C26	C25, C26
Lack of Planning & Compliance & Coordination Between Divisions	N07, N24	N07, N24	N24	N24	N24	N24	N24	N24	C01, C23, C26	N08, C01, C10, C23, C25, C26

NOTES:

* During the scoping session, these general issues areas were consistently identified as threats to ALL resource program areas, across the board.

** Denotes System-wide Cultural (C) and Natural (N) Resource Issue Codes (see appendix XXXX)

*** Historic Resources Include: Structures, Landscapes, Collections, Historic Resource Studies & Administrative Histories

LACK OF INFORMATION: AN OVERRIDING THREAT TO GRAND CANYON'S RESOURCES

It is suspected that many species of flora and fauna have declined almost to the point of extinction. Many cultural resources remain unaccounted for, yet are subject to vandalism as well as other threats....

Across the board, the issue which seems to threaten all park resources is the simple lack of information. "Information", here, is defined as the inventory and assessment of existing resources, their conditions, and their threats. It leads to an understanding of natural resources, ecosystem processes and cultural resources of the park. Without it, it is impossible to adequately detect, evaluate and monitor changes in resource condition.

In evaluating the issue statements (from the scoping session) within each of the resource programs in the above matrix, it becomes clear that a lack of understanding of park resources also leads to a lack of clear and comprehensive resource management goals and programs. A programmatic approach to resources management begins with a solid baseline knowledge of park resources. Lack of staff and funding, the inaccessibility of some park resource areas, and the pressures of other park programs and priorities have prevented the inventory and monitoring of significant resources. External and internal threats seem to be compounded by this overriding issue, where there lacks a clear understanding of not only the **magnitude of these threats**, but also the simple idea of what is threatened. The extent of our park resources and their current status is unknown and the thrust of this Resource Management Plan must be to bridge this gap in knowledge.

INCREASED VISITATION: THE UNFORGIVING THREAT

Ever increasing visitation is an issue which

has repercussions throughout the park. More and more planning for upgraded facilities (both inside and outside of the park boundaries), potable water supplies, visitor impacts, and rapid changes in visitor use patterns have taxed park resources and personnel. In 1993, annual visitation rose to nearly five million.

Although the park budget has not kept up with the demands related to increased visitation, park managers have turned over an ever increasing percent of the park base towards visitor facilities, services and maintenance, trying to meet these urgent needs. This further exacerbates the issue of lack of funding and staff for resource management. Increased demands for in-park development such as housing, visitor service facilities, improved roads and parking, etc., have added an expanded NEPA and NHPA compliance role for the resource management division; consuming an inordinate amount of time and energy in protecting resources in these small developed areas.

For example, the current General Management Plan (GMP) has proposed significant changes to developed areas, adaptively re-using many historic properties and impacting other areas. The ideas in the GMP are valid in that they will both improve the visitors' experience and mitigate overall impact to the park. However, there is insufficient staff and funding to adequately address how these historic properties can be preserved as part of this new plan. There is insufficient staff to survey new parking areas, infrastructure and visitor centers which are being proposed.

As was stated by the 1980 State of the Parks report, "*visitor needs are visible needs; now,*" while other resource problems are slow in developing and can be put off...until it is too late.

Over-visitation Impacts in

Wilderness: Over-use of wilderness areas, however, does pose a critical threat to the park. Over 23,000 visitors float the river annually during the primary and secondary (shoulder) seasons of use. Approximately 12,000 people hike and camp in the proposed wilderness each year, and approximately 25,000 camp in the inner canyon "corridor" area. Visitor experience throughout the recommended wilderness is not always consistent with the wilderness act. Visitors are crowded at camping areas and congested at attraction sites. Non-conforming uses, such as motorized boats and other vehicles within the proposed wilderness destroys the natural quiet. Over-visitation of sensitive springs and archeological sites are destroying these resources. However, these areas are typical "attractions" to canyon hikers and river runners.

Unfortunately, overcrowding has mostly been addressed and studied in park developed areas. Wilderness areas are "out-of-sight" and "out-of-mind" to many park visitors and staff, relinquishing mitigation proposals to the developed areas only. For example, only one river trip to monitor the season's impacts and one river-rehabilitation trip is launched every year to attempt to mitigate some wilderness areas impacts. Even these are at times viewed as unnecessary by some park staff who are confronted by daily problems within the developed areas.

LACK OF BASE FUNDING AND STAFF FOR RESOURCES MANAGEMENT

Although this threat is not definable in terms of resource impacts, it seriously affects the capability of the divisions' programs. Information remains unavailable if there is no staff or funding to collect it. The evaluation of the impacts of increased visitation is difficult to implement without employees or

money. Rehabilitation and re-use of historic structures becomes cumbersome and deficient without adequate analysis and documentation. Revegetation of areas impacted by visitor use is impossible without funding for the collection, propagation, installation and care of plants. Many types of operations performed by the Visitor Protection and Maintenance Divisions are considered to be resource management or resource protection activities; such as historic structures maintenance, trail rehabilitation, trespass stock control, etc. The consistency of these efforts and monitoring of their effectiveness and results, and therefore the refinement of procedures, is very limited.

The current base budget (FY94) for the resource management division is \$656,200. The current number of full time staff is 9, while six positions remain vacant. This is for all of 1,218,376 acres of a World Heritage Site.

Legal Deficiencies: The park is woefully behind in **meeting laws and mandates** regarding the protection and management of cultural resources. Areas proposed for wilderness are not always managed as wilderness. The extent and condition of archeological resources is not known. Historic properties have not been properly evaluated and registered. Safety risks associated with caves, mines, water quality and air quality are not only unabated, but are unknown for the lack of inventory and research. The impacts of new developments or proposed changes are unknown, and there is no funding or staff available to collect this information and develop management strategies prior to commencement of these developments.

EXTERNAL THREATS

During the scoping session, the Glen Canyon Dam was brought up several times as a

significant external threat to the park's natural and cultural resources, as was the human-caused visibility impairment produced by the Navajo Generating Station. To the credit of park management and resource management specialists, the past five years have resulted in persistence in addressing the gathering of considerable data and mitigation measures for these threats through the Glen Canyon Environmental Studies and air quality studies.

Air quality The Grand Canyon is veiled by a haze from cities, power plants and smelter, some are nearby and some are hundreds of miles away. Seventeen years after the 1977 Clean Air Act, air quality monitoring and the monitoring of haze over the park is still on-going. The EPA has recently ruled that a local coal-fired power generating station reduce its sulfur emissions by 90% to protect the air quality of the park. This issue has been subject to much controversy and publicity and park staff have represented the NPS in this matter.

The Glen Canyon Dam

Environmental Studies has (and still is) addressed the effects of the dam operations on natural resources, cultural resources, economics and recreation. Phase I indicated that the dam operations impact sediment deposits, riparian vegetation, native fishes and recreation. Impact to archeological sites, which are dependent upon sediment stability, has since been established, along with Native American concerns. Phase II was initiated to conduct additional studies on low and fluctuating flows in a framework that supports a decision process through an Environmental Impact Statement (EIS).

The passage of the Grand Canyon Protection Act directs the Bureau of Reclamation (BOR) to manage the dam to protect, mitigate adverse impacts to, and improve the values

for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. This includes, but is not limited to natural and cultural resources and visitor use. The Act directs the BOR to operate under Interim Operations until the completion of the EIS, scheduled in October, 1994. The Act also establishes measures for the implementation of long-term monitoring and research to determine the effect of dam operations on the downstream resources for the purpose of refining dam operations over the long-term.

Cooperating Agencies in the Glen Canyon Dam Environmental Impact Statement Process have not agreed on an organization for administering long-term ecosystem monitoring and research in support of the Glen Canyon Dam Adaptive Management Program. At issue is whether monitoring and research programs should continue to be administered solely by the Bureau of Reclamation. Long-term ecosystem monitoring and research programs for the Colorado River in Grand Canyon should be administered by the Department of Interior's Research Agencies (U.S. Geological Survey and the National Biological Survey) in direct response to the needs of the Department's management agencies (National Park Service, Bureau of Reclamation, U.S. Fish and Wildlife Service). The U.S. Bureau of Reclamation has yet to agree with this proposed solution. Some within BOR view ecosystem monitoring and research on regulated waters to be part of its "new mission". Native American tribes are concerned that the proposed solution might affect some of the funding support they have obtained through the Bureau of Reclamation's Glen Canyon Environmental Studies Program. The U.S. Fish and Wildlife Service and other cooperating agencies will be consulted before adoption of the long-term program.

Aircraft Overflights vs. Natural

Quiet: English writer J.B. Priestly commented on the powerful nature of the "quiet" within Grand Canyon: ". . . *There is an immensity . . . a silence so profound that soon all the noises from the life about us on the Rim were lost in it, as if our ears had been capture forever, drowned in these deeps of quiet.*"

Grand Canyon National Park, by far, exceeds all other parks in air tour flights over its lands. The air tour industry is comprised of 42 companies from five states. This multi-million dollar industry carries approximately 750,000 passengers averaging 80,000 flights per year. In the summer months, flights are estimated at 10,000 per month. Projections are that flights will double in number by the year 2010.

The Special Federal Aviation Regulation (SFAR) 50-2 has provided flight corridors and flight routes that air tours and general aviation must adhere to. Compliance with the regulation is high and the configuration of flight-free zones has helped to alleviate overflight impacts in most of the developed areas of the park. Research has shown, though, that the flight-free zones have not been as effective as planned and that certain portions of the park are still subjected to high levels of aircraft disturbance. Research has also shown that backcountry and river visitors are the most sensitive and unfortunately, the most subjected to such overflights.

A Report to Congress will be submitted in summer 1994 to address whether "natural quiet has been substantially restored to Grand Canyon". The park intends to report that this has not happened and will be developing alternatives for improving the current regulation. Whatever may come of the recommendations made, there will be a need

for a long term monitoring program to monitor acoustic levels, numbers of aircraft per route, compliance and impacts to visitors.

The current program has approximately half of a full-time position to handle this extremely complex and volatile issue. A minimum of 1.24 of a full-time position has been identified for this one issue (RMAP, 1993).

Endangered Riparian Ecosystems:

The emergence of a new threat has come to the attention of resource specialists, yet has not received much study so far. Major watersheds in the park originate far beyond Park boundaries (Little Colorado, Colorado, Paria, Havasu and Kanab Watersheds). Numerous drainages are contained entirely or largely within the Park (e.g. Nankoweep, Bright Angel, Shinumo, Tapeats and Deer Springs). These springs hold numerous values to canyon resources due to the uniqueness of water to this arid ecosystem. These riparian habitats and their relationship to canyon vegetation and wildlife systems have been threatened by the disruption of springs by well drilling and water extraction outside the park boundaries. Threatened and endangered flora and fauna species, such as the Kanab Ambersnail and ultimately peregrine falcons may be at risk.

Many of these water sources are traditional cultural properties. Over-use by hikers presents a serious threat to both cultural and natural resources of these "water-oasis" attractions in the arid canyon.

Exotic species such as Tamarisk are threatening both flora and fauna of these delicate riparian areas, by altering the habitat and the food web. The Southwest Willow Flycatcher (Threatened and Endangered Species) and bats (prey for peregrine falcon) are examples of species associated with these

riparian areas. Caves serve an important hydrological role in some of these riparian areas, and also contain a multitude of resource values.

Water developments and extractions outside of the park boundaries may have a serious impact on these inner canyon springs. Developers are trying to accommodate the millions of park visitors who are turned away every year due to the lack of lodging. The lack of easily accessible water sources has prevented such development in the past, but expensive and extensive well drilling has proved a sound investment today. This issue of urban encroachment affects multiple resources and will surely be the focus for the next five years.

Management of Wilderness: In September, 1980, the National Park Service recommended that 980,088 acres of land be designated as wilderness immediately, and an additional 131,814 acres be considered for potential wilderness designation. If adopted over 1,111,902 acres would be established as wilderness. Although the EIS and recommendation were submitted to Congress, it was never followed through.

In 1993, the National Park Service improved and resurrected the original recommendation. The revised proposal called for 1,109,257 acres recommended as immediate wilderness designation and 29,820 acres recommended for potential wilderness, for a total of 1,139,077 acres. This proposal is pending resolution of issues related to park boundaries and motor use on the Colorado River. This revision would require a new NEPA analysis, bogging the proposal down for months and even years.

Already, 14 years have passed since the original proposal. Uses which are contrary to appropriate management of recommended

wilderness are still seen today. These include the use of motorized equipment and mechanized transport on the Colorado River, which destroys the natural quiet of an otherwise wilderness experience. During his 1869 river expedition, Major John Wesley Powell often made journal notations about the "symphony" of natural sounds in the canyon. This symphony is not heard over the buzzing of motorboats on the river.

National Park Service responsibility for carrying out wilderness preservation mandates are shared by the Director, regional director, and superintendent. Clearly, the resolution of this matter is one of the highest priorities facing Grand Canyon National Park today.

Partnerships Within the Plateau:

Political boundaries have changed over the years. Different agency mandates and incompatible land uses at park boundaries have an undetermined impact on the park. Trespass stock and other alien fauna and flora cross park boundaries, sometimes critically damaging park resources, both natural and archeological.

Hunting, wood gathering, timber harvesting, developments, water diversions, and pesticides are other adjacent land uses which alter habitat, determine food availability, suppress populations and cause pollution of soils and water sources. Many wildlife species migrate in and out of the park boundaries, making them susceptible to adverse management activities on adjacent lands. Boundary fences are needed to prevent some of this activity. However, a nurtured partnership between land owners and managers is more useful in the long term. Currently, only one full time employee has collateral duty assignments in creating and maintaining these partnerships and this has proved dreadfully insufficient. A minimum of one full time employee devoted only towards this end is required.

Tribal Partnerships: It used to be that various Indian tribes would freely use the Grand Canyon as their place of worship. Now those who do not understand English are afraid to enter the park because they don't understand why they are charged entrance fees or arrested for traditional cultural practices.

The various Indian Tribes in and around Grand Canyon National Park also have an interest in protecting this sacred place. To them, the canyon is their "church"; to some it is their place of origin. Some groups are cognizant of any illegal or resource-damaging activities in areas where park management cannot access. They can alert the park about some of these activities, as partners in protecting the Grand Canyon. The Hopi presentation in Washington D.C. prior to the decision on Interim Flows for the Glen Canyon Dam Operation was so powerful that it influenced the Secretary of Interior's decision much more than any of the federal agencies.

Traditionally, there has been very limited dialog between the NPS and these groups. Recently, the park archeologist and superintendent travelled to meet with all eight tribes: Hopi, Havasupai, Hualapai, Navajo, Kaibab Paiute, San Juan Southern Paiute, and Zuni and _____.

These meeting revealed a great many issues and concerns which should be addressed by the new General Management Plan or by an Ethnography Program (currently non-existent): the tribes were disturbed about the amount of development underway on both the North and South Rims. They felt that although there was some interpretation about the Anasazi (Hisatsinum), it was just as important that visitors came away with some knowledge about *today's* various Indian cultures as well. The fact that concessioners

were allowed to sell cheap imitation Indian jewelry confused visitors and robbed tribes of business. The Park should instead be helping tribes in developing an environmentally sound economy which meets park management objectives. More issues were discussed, and each tribal interest was strong and preservation-oriented. .

The park should actively seek input from Tribal Chapter Elders, medicine men, and others not only as a matter of respect, but also because it will bring the Park towards a more holistic and comprehensive understanding of all values associated with Grand Canyon. The National Park Service is required to consult with tribes, based upon legislation and existing preservation compliance laws and NPS policies.

There are cases where traditional cultural uses have a negative impact on the Park. At Havasu, feral stock permitted by grazing rights and traditional use of the area is impacting Great Thumb Spring, an important riparian area. Memorandums of Understanding (MOUs) are in preparation between Grand Canyon National Park and the Hualapai, Hopi, and Zuni under the Native American Graves and Repatriation Act (NAGPRA), but a more focused government to government partnership is needed.. There is no Ethnography program at Grand Canyon, and the Indian Tribal Liaison position is only collateral duty for the park archeologist.

Plateau-Wide Protection Of Archeological Resources The Grand Canyon Trust recently released a publication, *Preserving Traces of the Past: Protecting the Colorado Plateau's Archeological Heritage*, a report which offers some comprehensive insight and recommendations. The following is an excerpt from the report:

" . . . There is no clear, collective vision regarding cultural resource management in the Four Corners Region. There are countless entities operating in the region, each pursuing its own agenda. There is significant competition, as a result, for funding, resource allocation, political and public support, economic development, media attention, etc. There is also no established forum for discussion, conflict resolution, future planning, or information sharing (Four Corners Governors Conference Report, 1990)."

Boaters rip roof beams out of ruins to use as firewood. Vandals spray-paint names over ancient Hopi clan symbol petroglyphs along the scared Salt Trail. The region's heritage is threatened not only by increasing vandalism, but also by losses due to development, grazing, dams, and by increasing numbers of visitors at archeological sites.

In 1987, The Government Accounting Office issued a report called, Problems in Preservation. They found that in 1987, nearly one third of 135,000 sites had been looted on Public Lands in the Four Corners Area. They estimate that 90% of archeological sites on public lands have been damaged in some way. This is only an estimate, however. Very limited inventories and surveys have been done to check this figure. The National Park Service, the report states, is one of the few places where preservation and protection are management goals, and Grand Canyon has no clue as to how much of their sites have been impacted. Only 2-percent of the park has been inventoried.

The Grand Canyon Trust found that federal land management agencies are too narrowly focused on complying with Section 106 of the National Historic Preservation Act, and that emphasis has prevented the achievement of other important archeological management

objectives: site avoidance is too often equated with site preservation, for example. Cultural resource managers spend excessive time on paperwork complying with Section 106, and not enough time out in the field inventorying and monitoring sites. Development and operations activities are dictating the priorities in cultural resource management.

Anthropogenic vs. Natural Change:

Because of the lack of understanding of ecosystem dynamics within the Colorado Plateau, resource related issues pose an unknown and therefore cryptic impact on park resources. It is important to understand what changes show natural variation and what are anthropogenic changes; eco-region-wide. Again, the deficiency of information on both park resources and external threats is the missing link in developing management strategies to deal with these pressing issues.

The Role of Interpretation and Education:

" . . . The problem with looting is not here in the Four Corners area. It is in the drawing rooms of Washington D.C., on the mantles of Boston fireplaces and on the walls of Los Angeles condominiums . . . Until the reaction to the private display of such artifacts is one of scorn rather than approval, those artifacts will continue to find a market . . ." (David B. Madsen, excerpt from Grand Canyon Trust publication, Preserving Traces of the Past)

The role of park interpreters is powerful and exciting. The potential impact that interpretation can make in the preservation of park resources, both natural and cultural, is

more far-reaching than many other resource management tools. Visitors can learn to stay on trails and avoid trampling vegetation. Spelunkers can better understand their potential impact in caves. The public can demand better funding and staffing of national parks.

Grand Canyon's interpretive programs are also stricken with tiny budgets and minimal staffs. Most interpreters who are trained as excellent educators end up showing visitors where to park and how to find public bathrooms.

Publishers, tour operators and other purveyors of archeological information can also be trained in and promote principles of proper etiquette.

INTERNAL THREATS

Crisis Management: Interdivisional communication and cooperation are key in achieving the best possible management of park resources. However, the pressures of increasing visitation, an active fire program, annual construction projects, a new General Management Plan, the employee housing initiative, the trans-canyon pipeline, and park maintenance activities have all resulted in separate programs; each pursuing a different schedule and priority. The Resource Management Division responds to these and many other programs by conducting surveys, analysis and documents necessary to obtain both NEPA and NHPA Compliance. These concurrent and coinciding priorities have resulted in a crisis management approach for resource management staff. Long term strategies and priorities for comprehensive resources management takes a back seat when the funding for a large housing project and sizeable fire program require immediate obligation and action. These crisis are the

greatest drain on the division's resources.

Planning and compliance must be integrated into a comprehensive park program which funds new resource specialists rather than taxing existing staff. It is imperative to avoid such crisis management and subsequent neglect of other park resources and more pressing park-wide issues.

Fire Suppression: Fire suppression over a period of 70 years has resulted in denser, more uniform plant communities. This has reduced habitat diversity, suppressing many plant and animal populations; contributing to their decline. Fuels have accumulated to the point where fires may rage out of control, destroying natural and cultural resources. Although there is an active fire program at Grand Canyon, there is minimal funding towards compliance and survey activities and research associated with prescribed burns in areas with both cultural and natural resource concerns.

Caves: Caves throughout the park contain unique cave formations or "speleothems," mummified remains of extinct Ice Age fauna, archeological remains, and unique biological systems. Many caves also play a major role in regional hydrology and canyon riparian systems, as evidenced by substantial streams emerging from Vasey's Paradise, Cheyava Falls, and Roaring, Thunder, and Tapeats Springs. In spite of their importance, management of caves and their resources has been haphazard. An outdated Cave Management Plan exists, and a permitting system has been devised, but both need updating and publicity. The full extent of caves and cave resources has not been systematically documented, nor is there an ongoing program monitoring these resources and mitigating impacts to them. Laws pertaining to and protecting caves and cave resources are not currently being met, as

there are no full time employees assigned to cave management.

Information and Collections

Management: Since the park was established and certainly even before that time, a steady collection of information, artifacts, archives, inventories, photographs etc., have been accumulating in the park. Some of this information and objects are contained in the park museum collections. A large database is stored in the park Geographical Information System (GIS). Together, with the park library, these data systems offer a wealth of clues, secrets, ideas, and studies to offer resource management alternatives.

However, much of this information is unavailable to park staff, resource specialists and researchers due to (a) insufficient cataloging and data input/database, (b) lack of

interagency and university networking and data sharing capabilities, (c) lack of a GIS system capable of organizing, analyzing and presenting large interrelational databases in spatially referenced format for easy use and (d) lack of staff.

The Museum Collections are threatened by inadequate storage facilities. A fire or theft/vandalism may eradicate all of the museum collections; eliminating years of research and study as well as destroying irreplaceable natural and cultural history artifacts. Artifacts, records, art, and archives are stored in a facility which offers no protection.

Due to the lack of data and information sharing throughout the Colorado Plateau, archeological and historical information which lend important clues for resource managers are missing.

These information management systems are critical and are key to all aspects of resources management.

NATURAL RESOURCE DESCRIPTION

The park comprises four natural geographic areas ranging in elevation from 1,000 to 9,000 feet:

- * The North Rim lies on the north side of the Colorado River, above, but not including, the canyon.
- * The South Rim is the area on the south side of the river, excluding the canyon itself.
- * The Inner Canyon is the area of the canyon itself including the river.
- * The Inner Gorge is a portion of the Inner Canyon below the Tapeats sandstone, in places over 1,500 feet deep, and is composed of hard metamorphic and igneous rocks.

INCLUDE MAP SHOWING THESE AREAS

CLIMATE

Starting at sea level, an individual would have to travel from northern Mexico (Lower Sonoran life zone) to Southern Canada (Hudsonian zone) to find as much climatic variation as there is within Grand Canyon National Park. This is due partially to elevation changes and partially to the unique effect the canyon itself has on weather.

The North and South Rims have rather severe winter temperatures, while summer weather is usually mild. In the winter, the North Rim, often buried under as much as 10 feet of snow, is closed to visitors. Average winter high and low temperatures are 39 and 18 degrees F respectively. In summer, days are generally clear and crisp with occasional afternoon thunderstorms or heavy rain. Evenings are chilly. Average high and low temperatures are 75 and 43 degrees F.

On the South Rim, winter often brings snow, with average high and low temperatures of 43 and 20 degrees F. During summer, afternoon showers, thunderstorms and occasional heavy rains may be expected. Average high and low temperatures are 82 and 51 degrees F.

In the Inner Canyon, daytime temperatures are extremely high during summer months, July being the most severe with daytime highs averaging 106 degrees F. The summer nights, however, are mild, with the average low being 78 degrees F. Winters are mild with maximum temperatures averaging 56 degrees F and with lows rarely dipping below freezing.

Precipitation also varies depending on location within the park. The North Rim receives the most precipitation with an average of 25 inches per year, while the Inner Canyon receives only 8 inches per year. Precipitation falls as frontal rain or snow showers in winter, or in thunderstorms mid

to late summer. Winter frontal rains develop off the coast of California and move west over Arizona and Grand Canyon. If these fronts move slowly, rain may fall for several days. Summer thunderstorms develop on most days from local convectional disturbances which are caused by excessive heating of the ground. These thunderstorms often result in intense rain and lightning. Storms usually last less than 30 minutes but often produce an inch or more of rain. During the months of July and August, thunderstorms are common all over Grand Canyon. In the Inner Canyon, these showers produce the greatest monthly precipitation of the year.

PHYSICAL RESOURCES

GEOLOGIC RESOURCES

The Grand Canyon of the Colorado River has long been recognized as a geological showplace. Geologic studies in the park began with the work of Newberry in 1858 and continue today. The Grand Canyon's excellent display of stratified rock is invaluable in unravelling the geologic history of the region, while the extensive dissection of the plateaus allows detailed study of tectonic movements. Processes of stream erosion and vulcanism are easily seen and studied.

The canyon is carved into four plateaus of the Colorado Plateau Province—a large area of the Southwest characterized by nearly-horizontal sedimentary rocks that have been uplifted 5,000 to 13,000 feet above sea level. The arid climate of the plateau has resulted in a wide range of striking erosional forms culminating in the Grand Canyon. The mile-high walls

of the Grand Canyon display a fairly undisturbed cross section of the earth's crust extending back some two billion years, from the Proterozoic Era to the present. The early-to-middle Proterozoic (Precambrian) Era is represented in the crystalline rock of the three "Granite Gorges." Originally deposited as sediments and lava flows, these rocks were intensely metamorphosed about 1,750 million years ago. Late Proterozoic rocks are only seen in the eastern Grand Canyon where a 13,000-foot sequence of sedimentary rock and lava flows was deposited in a coastal/shallow marine environment. Mountain building about 830 million years ago lifted and tilted these rocks. Subsequent erosion removed much of the sequence from most areas. The Paleozoic Era's layers are the most conspicuous in the Grand Canyon's walls. 2,400-5,000 feet of sandstones, limestones, and shales were deposited by several marine incursions from the west occurring from 550 to 250 million years ago. Layers from the Cambrian, Devonian, Mississippian, Pennsylvanian and Permian Periods are present. Evidence of the Mesozoic Era has been largely removed from the park, although there are small remnants, particularly in the western Grand Canyon. Studies of nearby outcrops indicate that as much as 4,000 to 8,000 feet of sedimentary layers from the "Age of Dinosaurs" once covered the Grand Canyon area. Cenozoic Era layers are limited to the western Grand Canyon. A few sedimentary deposits formed in lake beds, but most spectacular are the lava flows and cinder cones of the western-most Shivwits and Uinkaret Plateaus. Volcanic activity began about 6 million years ago and has continued to within the last several thousand years. Spectacular lava cascading down the canyon walls has helped date the Grand Canyon's carving.

The Grand Canyon itself is a late Cenozoic feature, characteristic of the renewed erosion of this time. Vigorous downcutting by the

snow-fed Colorado River has carved the depth of the canyon. Widening of the canyon has been held in check by the region's dry climate, resulting in the Grand Canyon rather than a more typical broad (and nondescript) river valley. Although violent storms may send flash floods gouging down narrow side canyons, the lack of steady moisture has created a stark landscape of mostly naked rock. Harder erosion-resistant rocks such as the Coconino Sandstone and the Redwall Limestone have eroded into bold cliffs. Softer layers melt into slopes like the Tonto Platform (in Bright Angel Shale) and the Esplanade (in Hermit Shale). The oldest, crystalline rocks are chiseled into the craggy cliffs of the Granite Gorges.

Nearly 40 identified layers of rock are found in the Grand Canyon's walls, and their lack of deformation have attracted students of the earth's history since 1858. Because most of the layers are exposed through the canyon's 277-mile length, they also afford the opportunity to make detailed studies of environmental changes from place to place (within a formation) as well as from time to time (with different formations).

It was the work of geologists that began changing the public's opinion of the Grand Canyon region from that of "a worthless locale" to "the most sublime of earthly spectacles." Today, the frontiers of geology have moved on from the Grand Canyon to the earth's crustal plate boundaries and to the planets and moons. Yet, studies of the Grand Canyon are not completed. In the mid-1970s, a new rock layer was identified in the canyon walls. Investigations of environmental effects on rock formation continue. Perhaps the biggest question of all—how the Colorado River chose this course and began the canyon's carving—still awaits a clear answer.

Issues Related to Geology

Although repeatedly referred to as a place for scientific research and education throughout the park's legislation and management objectives, geologic study is still lacking within the park's resource management division.

1. Earthquakes up to magnitude 5 typically occur about once a year at Grand Canyon. Strong shocks could threaten life and property.
2. The park provides a dramatic view of the earth's history, and thus an outstanding opportunity for interpretation to the public. (should this issue also include the lack of scientific research to understand the layers of unidentified rock?)
3. Abandoned mines pose safety and environmental risks in the park

SOILS

Extensive soil surveys have not been conducted within the canyon. However, analysis to date indicates that soils throughout the canyon have been categorized as poorly developed. Soils within the Grand Canyon are highly variable, ranging from moist forest soils of the North Rim to shallow, dry mineral soils and bedrock exposures of the Inner Canyon.

The Inner Canyon soil is a sandy loam that erodes very easily and regenerates slowly. The sandy nature of the soil allows for immediate absorption of water, leaving the ground dry even shortly after rain showers. The soils are typically fragile and require little disturbance to create erosional problems.

The soils along the Colorado River are known in more detail due to recently-completed research. Land areas in immediate

association with the river are characterized by fine-grained fluvial terraces (beaches), coarse-grained cobble bars, and tributary fan deposits. The fine-grained deposits found on the terraces of the river may be classified according to age of deposition (pre- or post-Glen Canyon Dam), agent of deposition (floods, eolian action, or fluvial reworking in the zone below present high water) and grain size (cohesive silts, which are predominantly silt in content, and sands, with negligible silt).

Human impacts on park soils include large areas with essentially no impacts, areas formerly used for farming, grazing and mineral extraction, and the heavily impacted soils of the developed areas. (Include something on cryptogamic crusts)

PALEONTOLOGICAL RESOURCES

Fossils found within the Grand Canyon encompass virtually the entire spectrum of types and preservation, including algal mats and bacterial spores over a billion years old, mummified dung and hair about 11,000 years old and a multitude of body and trace fossils from the Paleozoic Era, 550-250 million years old. The fossil record at Grand Canyon is rich. The presence of fossils in rocks of the region tells a great deal about the origin of these strata. Nineteenth-century geologists responsible for the earliest geologic mapping at Grand Canyon relied heavily on fossil remains to determine the age of the rock units and their equivalency with known strata.

The older Precambrian rocks of the Inner Gorge (the schist, gneiss and granite of the Vishnu Group) are not fossil-bearing, but the younger Precambrian rocks of the Grand Canyon Supergroup (specifically the Bass limestone) contain the oldest fossils in the region. These are stromatolites--primitive

algal remains very similar to present-day algal growths found in marine environments. Dated at approximately one billion years old, they represent some of the oldest fossils in the area.

The paleontologic record is richer for strata of the Paleozoic age, and these include nearly all of the horizontal layers visible from the canyon rim. Most of these fossils are remains of marine invertebrates which flourished at that time. Evidence of ancient life can be found in the non-marine rocks as well; the windblown units of the Coconino Sandstone contain vertebrate trace fossils—tiny footprints of ancient reptiles older than dinosaurs. The Supai Group and the Hermit Shale also contain footprints of ancient vertebrates.

Issues Related to Paleontology

1. The extent of fossil resources is not well known
2. Important localities need protection and focused research
3. Many fossil resources are commercially valuable and vulnerable to theft

WATER RESOURCES

General: Most of the flow of the Colorado River through the Grand Canyon originates in the high mountain areas that rim the Upper Colorado Region. The estimated annual runoff in the Colorado River at Lees Ferry, Arizona, at the head of Marble Canyon, has ranged from 5.6 to 24.0 million acre-feet. The 10-year means have ranged from 11.6 to 18.8 million acre-feet. Opinions thus differ concerning the period of record that best predicts future runoff. The significance of this fact is that a period of about 25 years (1906-1930) of predominantly

above-average runoff was used in development of the 1928 apportionment scheme and has been followed by a 40-year period (1931-1970) of predominantly below-average runoff. Current allocation accounts for nearly complete use of the Colorado River.

Springs and tributaries between Lees Ferry and Lake Mead contribute approximately 0.5 million acre-feet of water to the Colorado River annually. Despite the tremendous quantity of water flowing through the mile-deep canyon, the history of water supply at Grand Canyon has been one of insufficiency. As the river cut a canyon through the rock units, the ground water drained into the canyon. Collections of surface water are temporary and rare because of the ease with which precipitation penetrates into the substrata.

Historic Water Use: Some water was carried by mules to rim developments from the springs at Indian Garden prior to 1900 and other amounts were collected in natural or dug tanks and cistern catchments. The railroad to Grand Canyon Village was completed in 1901 and subsequently brought water to the canyon in tank cars. A sewage disposal plant was completed on May 28, 1926, and reclaimed effluent became available for non-potable uses. On August 26, 1932, the Santa Fe Railroad completed a pipeline to Indian Garden, about 3,200 feet below the rim at Grand Canyon Village. Pumps were installed with a capacity of 278,000 gallons per day.

The amount of water lifted from Indian Garden proved to be sufficient to meet the needs of a large influx of park visitors following World War II. Additional reservoirs were constructed on the rim to provide storage for water pumped during the slack winter season. Water storage capacity was approximately 4 million gallons by 1958,

and reached 13 million gallons by 1968. Water consumption in that year reached 96 million gallons, virtually the entire flow of the springs at Indian Garden.

For many years, the developed area on the North Rim at Bright Angel Point had obtained its water through a pipeline from Roaring Springs, a major source of Bright Angel Creek. In August 1970, a 13-mile-long transcanyon pipeline was completed which connected Roaring Springs with the pumping facilities at Indian Garden. The pipeline operates continuously, delivering approximately 720 gallons per minute to the Indian Garden pumping station except for those times when breaks occur in the line. The waterline has a maximum carrying capacity of 378.4 million gallons of water per year. The 1970 project also included the installation of two new pumps and equipment that provided a delivery capacity of 420 gallons per minute from Indian Garden to the South Rim through the 1932-era pipeline installed by the Santa Fe Railroad. Water from the transcanyon pipeline in excess of the pumping capacity of these new pumps is released into Garden Creek to return to the Colorado River. The springs at Indian Garden are now allowed to flow freely into Garden Creek.

Between 1985 and 1988 major improvements were made to the transcanyon waterline and pumping facilities at Indian Garden. A new 8-inch-diameter steel pipeline was installed from the South Rim to Indian Garden inside a directional drill hole. One new 750-horsepower pumping system was installed in the renovated 1932 pump house replacing the original pumps. A section of the transcanyon waterline from Plateau Point to the Colorado River was replaced with steel pipe and rerouted to avoid rock slides. Additionally, the pipeline from the South Rim Village to Desert View that was initiated in the 1960s was completed. A new one million gallon

reservoir also replaced the 325,000 gallon tank that serves the taller or higher elevation facilities of the South Rim Village. These improvements allow water to be pumped at a rate of up to 680 gallons per minute from Indian Garden when the new, larger pump is used; provide additional water storage at the South Rim; and allow water to be pumped the twenty-eight miles to Desert View in lieu of being hauled by tanker truck.

Maintenance problems still plague the pipeline. Due to friction from the tremendous water pressure, the life of the pipeline has been limited. It will cost approximately \$40 million to upgrade and extend the life of the pipeline. The environmental consequences of this project will be determined by the NEPA and NHPA compliance processes.

Water Rights: Water is a vital natural resource, especially in the arid southwestern United States, where legal and institutional systems are organized to control the use of water. In the Grand Canyon region, the use of water is subject to federal and state laws, interstate compacts and agreements to apportion the waters of interstate streams. Water rights are generally based on the appropriation doctrine in which first-in-time is first-in-right. Most surface water has already been assigned to specific applicants or users. The remaining supply is usually desired and actively pursued by numerous state and interstate groups as well as private individuals.

The federal government has asserted, and the courts have affirmed, that it has the right to water sufficient to develop federal "reserved" land such as that reserved for national parks, provided that the water is used for purposes of the reservation. The right is effective as of the date of the reservation action. The federal government thus has the right to use all waters originating in, or flowing through,

Grand Canyon National Park for park purposes. As of now, Grand Canyon has not quantified its federal reserve water rights for use of the Colorado River.

Because of the complex nature of water development projects, cooperation among water users is usually essential to make the projects possible. In 1922 the Colorado River states drafted the Colorado River Compact to apportion the river's waters. This compact was approved by Congress in the Boulder Canyon Project Act of December 21, 1928, and declared to be in effect by President Hoover on June 25, 1929. The compact divided the Colorado River into two drainage basins—Upper and Lower—with Lees Ferry, Arizona, as the dividing line between them.

Issues Related to Water Quality

There are several potential threats to the quality of waters in the Grand Canyon National Park. The Colorado River, Kanab Creek, and Little Colorado River drainages originate outside the park and are exposed to a variety of pollutant sources including mining operations, urban sewage, and uranium milling facilities. All are suspected of transporting pollutants into Grand Canyon National Park. A 1983 investigation of bottom sediment samples along the length of the Colorado River within the park indicates high levels of fecal coliform bacteria in many locations. Glen Canyon Dam flow levels and release patterns agitates the river bottom and bring bacteria, usually trapped in bottom sediments, to the surface adjacent to river bank campsites where contaminated water may be used by thousands of recreationists every year. Use of backcountry springs and streams by hikers, wildlife, as well as mule use along the trails, creates a health hazard by contaminating water.

A court ruling has held that in states under the Appropriation Doctrine, (such as

Arizona) Federal agencies are required to file on water rights to establish ownership. This will require the park to quantify all water resources within the park. In order to deal effectively with these varied and complex issues, the park has developed a Water Resources Management Plan.

Summary

1. Lack of adequate data to characterize natural conditions, resulting in an inability to establish water management goals.
2. Extent of health & safety problems are not established, but (bacterial) exceedances have been recorded and continue to occur.
3. Protection of life & property from floods: Most inner canyon campsites are located in areas prone to flash floods.
4. NPS actions may result in loss of wetlands: In the inner canyon, due to reconstruction of the trans-canyon pipeline and due to road construction on the North Rim.
5. External water developments could impact springs in the inner canyon.
6. Water diversions from Roaring Springs, via trans-canyon pipeline, affects NPS water and water-dependent resources.
7. Alternatives to current potable water sources need to be evaluated.
8. Information is needed to support NPS water rights claims. Adjudication is pending for the LCR.
9. It is unknown if continued sale of

water to Tusayan is consistent with existing legislation and NPS policy.

AIR QUALITY

Grand Canyon National Park enjoys some of the cleanest air left in the United States. This clean air is a fragile resource, and existing levels of human-caused pollution create clearly visible hazes. Numerous studies have been conducted to characterize this haze, its composition and origin. In addition to visibility studies, monitoring programs in the park measure acid deposition (both wet and dry), ozone concentrations, and meteorological data. Special studies have augmented this information with other data in support of special studies.

Class I Area: Grand Canyon National Park was designated a Class I area by the Clean Air Act as amended in 1977 (Public Law 95-217). The act requires the prevention of significant deterioration in air quality and gives added protection to areas of unique scenic value. Amendments in 1990 called for the creation of a Grand Canyon Visibility Transport Commission to study the interstate transport of air pollutants into the Grand Canyon area. The commission is to report to the Environmental Protection Agency (EPA) by 1995 on changes in air quality regulations and evaluate clean air corridors needed to maintain visibility in Grand Canyon.

Monitoring: Air quality monitoring at Grand Canyon has been ongoing since 1978, using a number of techniques to measure visibility, particulates, gasses and acid deposition. Research is intended to identify existing air quality and trends, measure sensitivity of park resources to air quality, establish local and synoptic weather patterns affecting air quality and identify sources and the nature of existing and potential pollutants.

Issues Related to Air Quality: Air quality at Grand Canyon is generally good, but is increasingly threatened by human sources, including metropolitan areas of Arizona, Nevada and California, as well as existing and proposed power plants and smelters in southern Arizona, northern Mexico and Texas. The net effect is a measurable impact on the visibility that is of paramount importance to visitor appreciation of the Grand Canyon. Visibility is often impaired in Grand Canyon National Park by haze even though pollutant levels do not go over National Ambient Air Quality Standards (NAAQS). Very small amounts of light-scattering pollutants can significantly reduce visibility. Haze results in a reduction in clarity and brilliance of the park and can eliminate distant views. Visibility at the Grand Canyon averages 80 miles, and can exceed 155 miles on the clearest days. Haze can reduce visibility to less than 50 miles, but visibility is still superior to many sections of the country.

Sulfates from fossil fuel combustion, smelters and urban areas account for over 60 percent of the visibility reduction at Grand Canyon National Park. A major local source of sulfur dioxide, the coal-fired generating plant at Page, Arizona, was the focus of intensive studies from 1987 to 1991, and will reduce its sulfur dioxide emissions by 90 percent by 1991. An EPA-sponsored study of the Mohave Power Project, a coal-fired generating station near the mouth of the canyon, will determine its contribution to haze.

Fugitive dust, smoke from wild and prescribed fires and natural organics also contribute to haze, but to a lesser extent. Ozone concentrations have been measured to be as high as 79 ppb locally, well below NAAQS standards yet above the threshold of damage to sensitive plants.

Presently, it is not known whether other park resources, including biotic and cultural elements, are adversely affected by changes in air quality or what levels of potential pollutants will cause significant resource damage.

Summary of Issues Related to Management of Grand Canyon's Air Quality

1. Visibility protection for the park and its integral vistas must be provided for.
2. Visitor enjoyment of the park is hampered by traffic pollution, smoke, light and aircraft noise.
3. Public Health and air quality standards must be protected.
4. There is a lack of baseline and effects information for air quality related values.
5. There is a need to educate the public through interpretive activities within and external to the park.
6. New Federal requirements for air toxics, hazardous air pollutants, operating permit programs, conformity, and regional haze must be met.

of the four North American deserts (Mojave, Great Basin, Sonoran) as well as montane ecosystems (boreal forests such as subalpine coniferous forests of spruce, fir and aspen), cold temperate forests and woodlands (ponderosa pine, pinion pine and juniper), grasslands (subalpine, plains and Great Basin), cold desertscrub, warm desertscrub and riparian woodlands/scrub.

The park contains over 1400 known vascular plant species within an elevation difference of almost 8,000 feet. This information was gathered through past surveys in certain sections of the park and herbarium specimens. A vast portion of the park, though namely the inner canyon, has never been surveyed. Therefore, the species list is quite incomplete. A recent survey of a small portion of the park found 195 species of lichen. Other non-vascular plants have yet to be surveyed.

Plant communities in Grand Canyon are classified in zones from the river to the rim. Along the river is a riparian community distinct from most other areas of the inner canyon. The river corridor represents an oasis in an otherwise arid area. Riparian vegetation exists because of the river and is dominated by arrowweed, willow, seep willow, mesquite and exotic saltcedar.

Inner Gorge vegetation outside the river corridor includes two different communities. The Mohave desertscrub community has its center of distribution at low elevations in southern Nevada and California. The most complete development of this community in Grand Canyon is at the extreme western end of the canyon. This plant community is dominated by creosote bush, white bursage, ocotillo, catclaw and some grasses. Upstream, in the Inner Gorge and above the river on the Tonto Platform, the narrow ribbon of Mohave Desert plants gradually decreases in species diversity and community development as the blackbrush plant community increases.

BIOLOGICAL RESOURCES

VEGETATION

The vast diversity of vegetation at Grand Canyon is most likely unsurpassed by many other national parks. The park contains three

The predominant plant of the Tonto Platform is blackbrush. Other common plants in this area are wolfberry, agave and narrowleaf yucca. While there are some species in common between the Tonto Platform and the Inner Gorge, the two communities differ in dominant species, general aspect, and environment.

The fourth plant association, the pinion-juniper woodland, at still higher elevations on the canyon rims, contains very few species in common with the other two. Characteristic species of the pinion-juniper woodland include several grasses, manzanita, pine, juniper and snakeweed.

The yellow or ponderosa pine association is more extensive on the North Rim than on the South. Typical plants in this community are yellow (ponderosa) pine, Gambel oak, locust, mountain mahogany, blue elderberry, creeping mahonia and fescue.

Above 8,200 feet is the spruce-fir forest with an intermixing of aspens. Typical plants in this community are Englemann spruce, blue spruce, Douglas fir, white fir, aspen and mountain ash. Interspersed throughout this community are montane meadows and upland subalpine grasslands. Typical plants include perennial grasses, sedges and forbs such as asters, penstemon, lupines and monkey flowers.

Endangered/Protected Species: Due to the wide diversity of vegetation at Grand Canyon and the unique geologic features, a relatively large amount of rare plants are known to exist. Currently there are 21 known protected plant species. This includes species protected under the federal Endangered Species Act of 1973. An additional 98 species in or near the Park have been assigned special status designated by other agencies.

The Federal Register, Part III, November 28, 1983, calls for candidate species to be treated as endangered species for planning purposes. Currently there is one federally listed plant species in the park, Astragalus cremnophylax var. cremnophylax. In addition, a federally listed plant occurs immediately adjacent to the park boundary, Pediocactus bradyi. There has been no survey within the park for this plant, but because suitable habitat exists, it likely occurs within the park boundaries. The other 15 species are Category 1 and Category 2 species currently being considered for listing. Records are kept on all of these species and survey work is done for areas under proposed development in the park. Information is lacking on the current population status of many of these species.

The Arizona Commission of Agriculture and Horticulture developed a Native Plant Law for the state, which protects certain native plants and makes unauthorized collection illegal. Grand Canyon supports this law by requiring researchers to obtain authorization from both the Commission and the park to collect these plants. The Resources Management Division maintains an updated copy of this state plant list.

Issues Related to Vegetation

Baseline Information: Although Grand Canyon has a completed 1984 vegetation classification map there is little known about the vegetation dynamics in the park and how they are related to internal and external threats. This map only provided a snapshot of vegetation types for that specific project. The classification field work did not establish permanent vegetation plots in order to follow changes in composition over time. Without such a system of plots, it is unknown if the vegetation classification has become obsolete in certain park areas. Little is also known about the location, extent and health of threatened, endangered and sensitive plant

species. An understanding of the impacts to riparian vegetation of the park, considered extremely important communities within the desert ecosystems of the inner canyon, is also unknown.

There is no complete database on these sensitive species. Status Reports were done for only six of the 21 plants approximately ten years ago. No work has been completed to update the status of the six plants or to determine an initial status for the rest of the species. Surveys for such plants are only done when disturbances to possible habitats are proposed. There is currently one known endangered plant in the park, Astragalus cremnophylax var. cremnophylax which is endemic to the park with a population of less than 500. The plant is protected by a fence and is monitored annually. Research on the plant's reproductive needs or germination needs is lacking as is the requirements of the plant regarding such environmental factors as precipitation or soil moisture.

Fire Management: Presence or absence of natural fire is one ecological factor which shapes and perpetuates plants and animals native to an ecosystem. Fire suppression has caused extensive change in the structure and vegetation composition of native forest and shrub communities. Many of the communities are considered fire-dependent for the perpetuation of natural processes. They are adapted to frequent, low intensity fires to remove undergrowth, provide an open canopy and good germination conditions for the native plants associated with these communities. Fire suppression has eliminated the opportunity for such low intensity fires in most areas of the park.

In the absence of fire, thick stands of young pine, spruce, and fir have closed in upon the once open park-like stands of forest on the North Rim. Lack of natural burning allows

tree crowns to close in and shade many forage plants which support much of the forest animal population. Dense stands of trees allow the rapid spread of forest infestations such as dwarf mistletoe, and the deep accumulation of forest litter improves the habitat for some nuisance insects. The crowding of trees contributes to the general slowing of growth rates and the lowering of resistance to disease and insect infestations. The large quantities of forest fuels which have accumulated because of fire suppression activities by the NPS have made many of the park's forested areas unnaturally susceptible to holocaust fires.

Unburned fuels due to fire suppression have accumulated to unsafe levels where wildfire threatens entire forest stands and endangers developed areas in the park. During the past twenty years, the park has accomplished less than 13% of the projected area to be treated by prescribed fire. The remaining 87% involves significant complexity, much of it without precedent to the National Park Service. There is a very serious need to manage fuels and vegetation in and adjacent to the developed areas of the park due to the significant threat to life, property and ecosystem integrity because of the fuels levels that have been allowed to build over eighty years of fire suppression. Also on the North Rim it is important to expand the prescribed fire zone into a portion of the wilderness in order to return to a natural fire regime. This may take decades to achieve because several large and complex management ignited prescribed fires must be executed near these areas, in order to reduce hazard fuel loads and restore natural forest stand composition and structure. Only limited scientific research has been completed to support the goals and objectives of the fire management program. There is a very significant need for better information concerning the role of fire in natural and altered ecological systems in the park.

Increased Visitation: Because of the enormous amount of visitation to Grand Canyon's rims and also its backcountry, the effects of trampling, social trailing, parking of vehicles and construction on native vegetation is often dramatic. Along the South Rim in the area of Grand Canyon Village, it is difficult to travel far without finding barren ground, root exposure of trees and social trails all due to overuse. In the heavily used portions of the backcountry and along the river corridor (inner canyon), erosion and vegetation removal is prominent. In such desert environs it does not take much use to create scars that can take decades to heal due to the fragile make up of soils and sensitivity of desert vegetation to trampling. Because of these impacts there are hundreds of areas on the rim and in the canyon needing active restoration and revegetation in order to return them to their natural state.

The Glen Canyon Dam poses another type of problem on the vegetation of the river corridor. Because flows have been controlled, an altered riparian system has emerged that promotes exotics over natives and has created altered vegetation communities in the old high water zone. Restoring the vegetation of the river corridor to a more natural state is an enormous task that must be addressed.

Revegetation: The current restoration program can only coordinate volunteers to assist with one or two projects per year. At this rate, the success of such a program is hard to determine since the bulk of impacted area remains. Those areas that do not get rehabilitated do not have an adequate program of evaluation to determine if techniques used are working in the long term. There are no planning documents that lay out strategies for restoration on a parkwide basis.

Under the funding of the Federal Lands

Highways Program (FLHP), a revegetation program has been established which rehabilitates those areas disturbed by road construction activities. Although the program has been successful, no monitoring of the revegetated areas has been done.

Alien Plant Species: There are at least 70 exotic plants known in Grand Canyon. Their extent and impact is currently not known. Although the South Rim area was inventoried about 10 years ago, no other inventories have been completed to date. It is apparent that such species as Tamarisk pose a great threat to the native vegetation especially of riparian areas. Hundreds of acres of native vegetation have been replaced by Tamarisk along the Colorado River and its tributaries. Many springs vital to wildlife and humans are also being invaded by the plant. Other exotic plants are more specific to certain regions of the park and may be more easily controlled.

In summary, the following issues are all pertinent to vegetation management at this time:

1. Lack of information concerning the role of fire in the natural system (and altered system).
2. Need for integrated planning and compliance documents to implement a comprehensive program for the protection of park resources.
3. Lack of consistent methods of monitoring vegetation to provide credible scientific information. Lack of documented protocol for institutional memory and consistent application through time.
4. Lack of basic resource data and adequate monitoring protocols for long term trends.

5. Need to monitor changes in plant species populations and vegetation over time.
6. Lack of understanding of ecosystem dynamics.
7. Lack of understanding of effects of human activities on ecosystem functions.
8. Need to expand efforts for revegetation/rehabilitation of disturbed sites; need for native species propagation.
9. Need to manage vegetation and fuels in developed areas.
10. Lack of knowledge and comprehensive management program for T&E species.
11. Lack of knowledge and comprehensive management program for exotic species.

WILDLIFE

Due to the wide range in elevation and habitat types, the park supports a large number of different species including 58 reptiles, 287 birds, 88 mammals, numerous invertebrates and 5 native fishes. Grand Canyon is considered by many biologists to represent a very valuable wildlife preserve due to the size of the park and the relatively unfragmented habitat resulting from the preservation policies of the National Park Service.

Mammals: Approximately 22 species of terrestrial mammals and seven species of bats are known to occur within the riparian zone of the Colorado River. On the beach and terrace habitats, rodent species are most

common, comprising an average density of about 20 individuals per acre.

Carnivorous mammals include bobcats, coyotes, foxes and mountain lions, which are uniform in distribution but rare. Spotted skunks and ringtail cats have reached high population densities in developed areas. Larger mammals include mule deer and desert bighorn. Bear were sighted on the North Rim in 1991.

Approximately 25 species of terrestrial mammals and seven species of bats are known to occur within the Inner Gorge and pinion-juniper communities on the rim. Again the most common mammal group is the rodents, with 16 species inhabiting the desertscrub community of the Tonto Platform. Such large mammals as coyotes, foxes, mountain lions and mule deer are present but rarely seen. Wolves once roamed the North and South Rims, but were exterminated. (Desert Bighorn?)

Birds: Most birds of the Grand Canyon are part-time residents—either migratory or seasonal inhabitants. Of the 287 species, only 43 are permanent. Many of the seasonal residents use Grand Canyon for nesting. Many of the water birds found along the river are migratory and use the river corridor for a few weeks during the spring and fall. Birds of the Tonto Platform use sparse open scrub and small trees for nesting sites.

Amphibians and Reptiles: Amphibians are not common on the Tonto Platform or even along the river and tributaries. Arid conditions during most of the year preclude an abundance of these animals. The species that are present show a high degree of specialization for a desert environment. Reptiles fare much better in the arid climate of the inner canyon. The Tonto Platform has a large number of lizards and snakes.

Endangered/Protected Species: The following park animals are on the official list of endangered or threatened wildlife that is maintained by the Fish and Wildlife Service.

- a. Bald Eagle, Haliaeetus leucocephalus
- b. American Peregrine Falcon, Falco peregrinus anatum
- c. California Brown Pelican, Pelecanus occidentalis
- d. Humpback Chub, Gila cypha
- e. Colorado River Squawfish, Ptychocheilus lucius
- f. Razorback Sucker, Xyrauchen texanus
- g. Desert Tortoise, Gopherus agassizii

The List of Threatened and Unique Wildlife of Arizona, developed by the Arizona Game and Fish Commission, includes several species found within the park (Appendix XXX).

Issues Related to Wildlife

Baseline Information: Standard references describing species composition and distribution for mammals, birds and heptofauna in the park have been completed. While additional information on range and population of selected species is needed, an acceptable database for park fauna (except invertebrates) has been established. The life history and habitat requirements are well documented for the Kaibab squirrel. However, the long-term well being of this species is not fully understood. Less is known about the life history of the endangered humpback chub. The only known reproducing population of this fish in the park occurs at the mouth of the Little Colorado River. Very little is known about the population of bighorn sheep within the park. Research is needed to determine current status of sheep within the park. Grand Canyon National Park has an

estimated 25 to 40 breeding pairs of Peregrine falcons (American Peregrine Falcon Recovery Team). This is the largest population of Peregrine falcons in North America outside of Alaska. However, a thorough inventory is needed to verify this information and to provide a baseline for establishing a monitoring program.

External threats include: trespass stock grazing, hunting, wood gathering, timber harvesting, developments, water diversion, pesticides, and introduction of exotics. These activities effect wildlife in a number of ways by altering habitat, determining food availability, suppressing populations, pollution of soils and water sources, and introducing exotic species which compete with native species for shelter and food.

The Grand Canyon National Park Enlargement Act of 1975 added to the park some lands on which grazing was occurring at that time. These grazing permits expired in 1985. Roads trails and scattered stock tanks have been abandoned, and the area (which is classified as "poor, infertile, with a lack of naturally occurring surface water") is gradually reverting to a natural state. The Havasupai Reservation gained 83,809 acres under this 1975 Act, where their livestock now compete directly with desert bighorn sheep for food and water. Grazing stock belonging to individuals of the Navajo Tribe trespass the southeast corner of the park. Livestock trespass also occurs along the Kanab Plateau boundary of the North Rim, with frequent trespass along the Kaibab Plateau. Livestock trespass is also increasing in the South Rim developed area due to the railroad corridor

The Glen Canyon Dam operations on the Colorado River, have resulted in numerous introductions of exotics, colder water temperatures, and changed flow regimes

which have resulted in the extirpation of the boneytail chub and the Colorado River Squawfish and reduced habitat for many other natives.

Many wildlife species migrate in and out of the park making them susceptible to adverse management activities on adjacent lands. This is particularly true of ungulates such as elk and deer and the animals which prey on them such as coyote and mountain lion. This is also true for the many birds species which are impacted by management actions in other parts of the United States, Canada and South American.

Internal threats to wildlife result from park developments, introduction of exotics, and past fire suppression practices. Fire suppression over a period of 70 years has resulted in denser more uniform plant communities reducing habitat diversity and suppressing many plants and animal populations. This is particularly true in the park's forested areas where in addition to increase plant density is added heavy buildups of dead and down trees. This change in plant communities is suspected of altering the fauna composition of the area and may have contributed to the loss or severe decline of many species.

Park management of wildlife is severely handicapped by lack of adequate data on wildlife populations, their habitat needs, and an understanding of communities/ and park ecosystems. Inadequate: funding, staffing and staff housing has prevented this program from being developed to the point where basic data can be collected for use in evaluating the status of the park's wildlife, identify threats, and develop management actions to protect this valuable park resource.

Summary of Issues Related to Wildlife Management

The following issues were discussed as primary concerns in wildlife management during February's interdisciplinary scoping session:

1. Lack of adequate data and understanding of organisms, communities, habitats, and ecosystems for management.
2. Lack of adequate conceptual and institutional (Information management) structure for data.
3. External threats - air quality, adjacent lands management, Glen Canyon Dam, mining, water usage, etc.
4. Inability to implement programs because of lack of money, time, people, housing, equipment.
5. Incompatible land use on park boundaries.
6. Lack of monitoring causes failure to identify threats.
7. Internal threats - lack of interdivisional communications and cooperation.
8. Increased visitation
9. Fire management is not integrated with Resources Management planning.
10. Concessions operations not integrated with Resources Management planning.
11. Water withdrawals (ground and surface water supplies and quality) within and outside the park potentially affect wildlife. This is not monitored or studied.

12. Introduction and incursions of non-native species is not monitored and uncontrolled.
13. There is a need for proactive Integrated Pest Management.
14. The existence of differing agency mandates leads to inadequate information exchange and management conflicts between the park and other agencies.
15. Unrealistic public perceptions of wildlife lead to inappropriate behaviors and expectations.

RECREATIONAL RESOURCES

A wide diversity of resource-based recreational opportunities and support services help visitors experience, enjoy, and appreciate the park. The vast majority of the park provides opportunities for wilderness experiences. Hundreds of miles of trails and routes provide access to park resources and diverse recreational opportunities and experiences. The Bright Angel Trail, Kaibab Trail, and River Trail are designated national recreation trails as part of the national trails system. The Arizona Trail is planned to pass through the park. The Colorado River, as it flows through the park, provides opportunities for one of the world's premier river experiences, including one of the world's longest stretches of navigable white water.

The Grand Canyon National Park backcountry consists of over one million acres of primitive lands and proposed wilderness, approximately 240 free-flowing miles of the Colorado River, and the developed inner canyon "Corridor" areas including Indian Gardens, Phantom Ranch

and Cottonwood. Over 23,000 visitors float the river annually. Approximately 12,000 people hike the proposed wilderness each year, and approximately 25,000 camp in the developed Corridor campgrounds. Total annual use is approximately 233,000 user nights.

All of the natural, cultural and scenic qualities of the Grand Canyon, coupled with the canyon's vast size, give rise to inspirational and spiritual values and a sense of timelessness. The Grand Canyon is recognized as a place with unusual and noticeable natural quiet, and direct access to numerous opportunities for solitude.

The Grand Canyon has internationally recognized scenic vistas, qualities and values. With ever changing and colorful scenery, of enormous proportions, it is widely considered one of the world's most beautiful natural areas. The great variety of scenery includes forests, deserts, canyons plains, plateaus, volcanic features, streams and waterfalls.

The canyon is an excellent place for night sky viewing. It's Class I air quality is extremely important to its scenic quality (i.e. visibility, colors and details).

Issues Related to Recreational Resources:

Visitor experience throughout the recommended wilderness is not always consistent with wilderness. Visitors are negatively impacted by crowding at camping areas and congestion at attraction sites. Non-conforming uses, such as motorized boats and other vehicles within the proposed wilderness also negatively impact visitors. Resource impacts continue to occur at numerous campsites and visitor attraction sites. Campsite expansion and the development of social trailing are the primary impacts.

The proposed wilderness contains 30 hiking trails of approximately 375 miles. Eighteen of these "backcountry" trails (approximately 260 miles) contain historic features (i.e. retaining walls, tread riprap, log cribbing, etc.). Most of these trails have received little or no stabilization or rehabilitation work since establishment of the Park over 75 years ago.

Issues Summary

1. Must meet laws, policies, wilderness designations, etc. to be in compliance with legislation associated with recreation uses.
2. There is a lack information concerning the effects of increased visitation on both resources and visitor experiences.
3. There is a lack information concerning the effects of various visitor recreational uses on park resources and analyze conflicts between visitor uses.
4. There is a lack of management strategies to mitigate visitor impacts on park resources.
5. There is a lack of management strategies to mitigate the conflicts between visitor uses.
6. There is a need for integrated planning and compliance to implement a comprehensive program for the protection of park resources from visitor uses, and also to enhance the visitor's understanding and enjoyment of the park.

CULTURAL RESOURCES DESCRIPTION

Overview: Grand Canyon National Park is rich in cultural resources; the park records nearly 3,000 prehistoric and historic sites. This inventory is based on a less than two percent survey of the entire park. Resource categories described below are prehistoric resources, ethnic and ethnohistoric groups and historic resources. The List of Classified Structures (LCS) and the National Register of Historic Places are management tools which are used in the active monitoring and preservation of the resources.

Knowledge about Grand Canyon's cultural resources has come from research and reporting begun in 1540 AD during a trip by Spaniards to the canyon rim. However, most knowledge has been acquired in the last few decades. Extensive inventories and mapping of archeological resources have been accomplished over the last 15 years. Preliminary evaluations of architectural and historic resources were made in 1974 and 1976 by architects, historians and architectural historians from the National Park Service Western Regional Office and Denver Service Center. These studies were part of a servicewide commitment to identify properties eligible for the LCS and were required for completion of the Grand Canyon Village Development Concept Plan.

PREHISTORIC RESOURCES DESCRIPTION

The archaeological resources of Grand Canyon encompass a wide variety of cultural remains indicating use of the canyon by

people over the last 10,000 years. With approximately 2% of park lands systematically surveyed for 2700 archaeological sites, we estimate that our resources may total over 50,000. A single fragment of a **Paleo-Indian** projectile points suggests the possibility of use by big-game hunters at the end of the Pleistocene period nearly 10,000 years ago.

Archaic hunters, possibly of the Pinto Basin Desert culture, placed willow or cottonwood split-twist figurines in caches in caves presumably for the purpose of imitative magic. Dates have been determined through radiocarbon analyses of the figurines. At this time, no diagnostic artifacts have been found in direct association with the figurines, although Pinto Basin projectile points have been found in their vicinity. Small campsites, projectile points and rock art provide further evidence of the Archaic tradition at Grand Canyon National Park.

Additional information has been obtained in recent years indicating an expanded Archaic occupation. Test excavations conducted at five selected sites in the inner canyon in 1984 and limited sampling of additional sites along the Colorado River in 1989/90 have produced radiocarbon dates well into the late Archaic/early Basketmaker period (2100 BC to 500 AD). In addition, Archaic style rock art has been documented in the Tuweep district of the park, along with diagnostic projectile points from various locations. With the added information of probable **Archaic and Basketmaker** occupations in the canyon, the period of time from the Archaic to the later pueblo inhabitants is no longer a mystery.

People moved in and out of Grand Canyon, leaving behind evidence of their lives here. Thousands of dwellings, shelters, and agricultural terraces have been located, providing evidence of ancestral **Pueblo**

farmers living on both rims and in the inner canyon. Pottery, chipped stone, ground stone, and other artifacts remain to help tell the story of these people and their passing through the canyon between 800 and 1200 years ago.

The evidence of human occupation increases after around 500 AD. Remains of early pueblo period sites have been found at locations throughout the park. Diagnostic **Basketmaker** projectile points have been found eroding from a few middens, and information from excavation of a cluster of pithouses in the Tuweep District attest to this presence. Slab structures and circular pithouse-like dwellings along with early **Kayenta** ceramics and lithics are found in rock shelters and occasionally in the open.

Peak prehistoric population and maximum use of the canyon appear to have occurred roughly between 1000 AD and 1150 AD. Sites are found in almost every possible type of location from the river to both rims. Riverine sites consist mainly of masonry pueblos of one to several rooms with occasional water/soil control features. The high Pleistocene terraces and other river terraces are also characterized by open masonry pueblos. Granaries and small habitation sites are found on talus tops throughout the Inner Canyon. The remains of single room sites and mescal pits dot the River Corridor and the Tonto Platform. The Esplanade (topographically a higher platform) has revealed a number of open masonry pueblos, rock shelter sites and mescal pits. Other trailside sites, usually granaries, caches and small habitation sites, are found throughout the Supai formation. A few hundred meters higher, small cliff dwellings are found, and at the rims, small open masonry sites of from one to a dozen rooms are located, many of which are accompanied by check dams and terraces. Single and multi-room dwellings, kivas, and granaries

were built of jacal and masonry, dry and wetlaid, coursed and uncoursed. These types of sites as well as caches, water/soil control systems and more ephemeral sites such as artifact scatters and low masonry walls in rock shelters attest to full use of the seasonal abundance of the canyon, and range in size from a single broken ceramic vessel to a 20-room masonry structure with associated kiva (up to 3000 square meters). The majority of these sites were occupied by pueblo peoples, the **Anasazi** or, as the Hopi call them, **Hisatsinom**.

At about the same time, members of another **Anasazi** or **Hisatsinom** group from the vicinity of the Virgin River were occupying the western part of the park north of the Colorado River. In addition, intensive use was made by the **Cohonina** of the South Rim, the Esplanade and Havasu Canyon. The activities of this group include similar intense use of the canyon's various microenvironments. However, there is more variability in types of structures and less emphasis on agriculture with a consequent increase in gathering. Hundreds of mescal roasting pits in protecting rock shelters and abundant lithics are scattered over the Esplanade.

Climatic shifts apparently dictated the abandonment of Grand Canyon shortly after 1175 AD. Tree ring analysis indicates that Tusayan Ruin on the South Rim was one of the last sites occupied with abandonment by around 1225 AD. At least by 1300 AD, and possibly earlier, **Southern Paiute Indians** moved into the area north of the canyon and made occasional use of the resources below the rim. Rock shelters and other limited activity campsites are found on the North Rim, where dense forest and alpine meadows created good habitat for wildlife such as deer and below the rims, where water and edible plants would have been more plentiful. Occasional Paiute ceramics found south of the

river indicate contact with the population there. More research needs to be done to determine the nature and extent of this contact as well as that which existed between North and South Rim peoples prior to 1150 AD.

During the same time period, Indians of the **Cerbat Branch** moved from the Lower Colorado River Valley into abandoned Cohonina territory. Cerbat sites resemble those of the Paiute with the exception of ceramic types and the more intense exploitation of the abundant mescal growing on the Esplanade. Also, agriculture played a fairly important part in the economy, as shown by ethnographic analogy. Little change seems to have occurred in the subsistence patterns and cultural traits from 1300 AD, with the arrival of the Cerbat, until the nineteenth century and the intrusion of the **Anglo-American** culture into the **Havasupai** and **Hualapai** ways of life.

The **Hopi**, **Zuni**, **Southern Paiute** and **Navajo** all left remains that have become part of the archaeological record. These same people continue to use the canyon today for traditional and religious reasons.

In addition to the prehistoric and historic Native American archaeological legacy, **Euro-American** history, from the time of contact in 1540 through development of the NPS is represented in the archaeological record. The majority of the historic archaeological record comprises evidence of early exploration (John Wesley Powell and Robert Brewster Stanton), exploitation (early mining sites from Ralph Cameron, Pete Berry, William Wallace Bass, and John Hance), and tourism (Grandview and Buggeln Hotel sites, Hance Ranch, and Bass Camp).

Issues Related to Archeology

Baseline Information: The major issues and threats facing archaeological resources in Grand Canyon stems from the lack of baseline resource data. Without baseline information, it is impossible to construct a coherent plan to manage these resources.

Increased Visitation: Degradation from natural processes and increased visitation is affecting the archaeological resources. Increasing visitation to the park, in particular in the backcountry, threatens the very existence of the archaeological resources. Increased visitation, without monitoring or mitigation (due to a lack of staff and funding), exposes archaeological sites to higher rates of general degradation and vandalism. Without basic inventory, not only do we not know where our resources are, but we do not have a mechanism for insuring preservation. These basic issues are core to federal responsibilities under the National Historic Preservation Act (NHPA), sections 106 and 110, and the Archaeological Resources Protection Act (ARPA).

Legal Responsibility: Recent changes in legislation have increased our legal responsibilities for both preservation and consultation related to cultural resources. In particular, changes in NHPA and ARPA, and the implementation of Native American Graves Protection and Repatriation Act (NAGPRA) require expanded response from park staff, an organization which is woefully understaffed at the present time.

Safety: Higher visitation and the lack of baseline data or staff to monitor site conditions brings the potential of increased danger due to hazards at some archaeological and historic sites. These sites, primarily abandoned mines and cowboy camps, contain hazardous materials such as explosives which

pose a threat to public and staff health and safety.

Increasing development and the preparation (and implementation) of the park GMP will have an effect on archaeological resources. Without baseline information, decisions are made concerning NPS developments without the necessary resource information which should be used to guide decisions. In addition to the GMP, other park plans, such as the fire management plan, backcountry management plan and river management plan, need basic information concerning archaeological resources to insure that the plans reflect resource concerns and preservation. Full integration of resource concerns should be included in the planning for these programs. Due to our limited database and limited staff, these concerns are often overlooked.

Colorado Plateau-Wide Perspective:

The archaeological resources of GRCA cannot be viewed in isolation from the remainder of the Colorado Plateau. The archaeological record adds much to our understanding of the human role in the changing ecosystem. This must be viewed as part of the larger ecosystem of the Plateau and the data from GRCA is an important component. An Ecosystem Management approach needs to include:

- a) Establishment of partnerships which focus on new roles for park neighbors (plateau communities, agencies, tribes)
- b) A critical need exists to increase our understanding of the human role in changing ecosystems. This involves a greater understanding of the role of technological and cultural knowledge systems in adapting to an ever changing ecosystem. Archaeology provides time perspective needed to

understand change in many components of the ecosystem.

Interpretation: Each time an archaeological site is recorded, our ability to interpret the past to the visitor is greatly improved. The public wants to know, and our understanding of the resources of the park is critical to that exchange of knowledge.

Interest by the public in both archaeology and contemporary Indian issues has seen a dramatic increase. There is a need to expand park interpretation to include these issues with an emphasis on resource preservation.

Summary of Issues Related to Archeology:

1. Lack of baseline cultural resource data throughout the park (you can't manage resources unless you know what and where they are and what threatens them.)
2. Visitor/natural impacts from increasing visitation levels and natural processes—ongoing destruction/vandalism/loss.
3. Laws and park mandates (1975 Enlargement Act, World Heritage designation, NHPA, NAGPRA, etc.)
4. Safety (abandoned mines, prescribed fire to reduce fuels, etc).
5. Need for an ecosystem management initiative
 - a) partners (Colorado Plateau/neighboring agencies/increasing voice & political role of Native Americans in management)
 - b) understanding the human role in a

changing ecosystem (importance of understanding the role of technology and cultural knowledge systems in adapting to a changing ecosystem: archeology, ethnography, past/present and future applications).

- c) archeology provides the time perspective.
- d) archeology can shed light on many other issues (vegetation change/climate change, etc).
- e) A need for long-term monitoring and remedial actions program related to the operations of Glen Canyon Dam.
6. Need to meet public demand/increase public interpretation/increase public understanding (through increasing/understanding we increase appreciation and thru increasing appreciation, increase protection and preservation)
7. Need to maintain government-to-government relationships with tribal partners/self-determination of role in park management by tribes:
 - a) mgmt of adjacent lands
 - b) use of park resources
 - c) impacts to Traditional Cultural Properties (TCPs)
 - d) traditional and religious needs
 - e) Indian Reorganization Act (IRA) governments vs. traditional leaders
8. Effects of NPS activities, park development, maintenance activities, Fire, backcountry, etc.
9. Need to integrate planning and compliance into a comprehensive park program.

ETHNOGRAPHY

An ethnographic resource is defined as any natural or cultural resource linked to the traditional practices, values, beliefs, history and/or ethnic identity of a cultural group or groups.

Grand Canyon has been home to various groups of people for thousands of years. These people, both native Americans and more recent Euro-Americans, have utilized the canyon as both a home and a place linked to traditional practices, values and beliefs. To the Hopi and Zuni, the Grand Canyon represents their place of origin into this world. For Hopi, it also represents the place where their spirits come to rest after death. Although the Anasazi (Hisatsinom) migrated the canyon area, their descendants, the Hopi, continue periodic visits. Trips are made to gather ceremonial salt from the salt deposits along the eastern section of the Colorado River and to the Sipapu, a mineral spring located just outside the park boundary on the Little Colorado River which is believed to be the place of origin for the Hopi.

For the Pueblo (Hopi and Zuni) people, archaeological remains in the canyon provide evidence for their migration from their place of origin to their present homes. For the Pai (Hualapai and Havasupai) people, the canyon and the river are the lands they have been entrusted to care for. The river represents the backbone. For the Southern Paiute, it has always been. . . Navajos also made limited use of the eastern portion of the canyon beginning in the 1880's.

Euro-Americans recognized the spiritual values of the canyon in the establishment of the National Park in 1919. World Heritage designation told the world that the Grand Canyon had value beyond just the American people. The 1975 Grand Canyon

Enlargement Act specified natural quiet and the view as important, yet intangible qualities, that must be protected. These, too, are ethnographic resources.

Traditional Uses: Pine nuts are still collected by Indians and non-Indians. One small group of Havasupai continue to live approximately one mile west of Grand Canyon Village in Supai Camp. The 1975 Grand Canyon Enlargement Act enlarged the Havasupai Reservation by 185,000 acres, at which time the tribe relinquished any further rights within the park. The act also allotted them 95,3000 acres of NPS land, termed Havasupai Use Lands (HUL), for "grazing and other traditional purposes."

Issues Related to Ethnography

Lack of a Program: The major issue facing the Ethnographic Resource Program at GRCA is the lack of a program separate from the Archaeological Resource Management Program.

Lack Of Baseline Data: Specifically, there is a lack of baseline data for the park. No database exists, and no information exists which can be used in park planning and management. The only inventory information that exists for ethnographic resources is that which has been obtained through archaeological studies and consultation of compliance generated projects.

Legal Responsibilities: We have a responsibility to comply with numerous federal laws related to ethnographic resources and traditional cultural properties which is being done in a piece-meal fashion, with no coherent plan. Baseline studies have yet to be completed to assess the ethnographic resources of the park. With 8 separate Indian

Tribes which claim ancestry in the canyon, the lack of information hampers any program development.

Boundary Disputes: Numerous pieces of legislation exist establishing the boundary locations for Grand Canyon National Park and the Hualapai and Navajo Indian reservations. The legal descriptions are in conflict and resolution of the location has not been reached.

Representation: During the scoping session of the current General Management Plan (GMP), many Native American groups expressed their continued concern over the years that their heritage and values are not well represented within the management of the park and that the visitor must be better educated about their existing cultures. Traditional practices, concession exploitation of non-authentic Indian goods and non-representation of Native American groups in park management and operations are all examples of frustrations they experience.

HISTORIC RESOURCES

Period of Exploration: Evidence of the interaction of European man with the canyon is another phase of cultural development within the park. The historic period begins with Don Garcia Lopez de Cardenas' exploration in 1540 AD of the South Rim and possible routes to the river. In three unfruitful days, he reached neither the river nor the Havasupai of whom he had been told by local Indians. European contact with both Havasupai and Southern Paiute in their homelands occurred in 1776 with visits by the Franciscan priests, Francisco Garces and Silvestre Velez de Escalante, respectively. Both accounts of the Indians, although

relatively brief, are the first descriptions of any type of cultural resource within the park. For Europeans, the immense chasm was a barrier from the beginning. The discovery of the Grand Canyon by an explorer from the United States reportedly occurred in 1826 when a fur trapper named James Pattie traveled down the Colorado River. The Grand Canyon became United States territory officially in 1850 and exploration began in earnest. The daring scientific expeditions down the Colorado River led by Major John Wesley Powell in 1869 and 1871 were the most significant in terms of mapping and exploration.

Pioneer Settlement: The pioneer settlement of the Grand Canyon area began with the establishment of a ferry across the Colorado River by John Doyle Lee in 1871 at the mouth of the Paria River. Settlement by ranchers and miners did not really progress until the railroads reached the towns bordering the Grand Canyon (such as Flagstaff and Williams in 1880's). Prospectors also began to explore the Grand Canyon in the second half of the 19th century and established numerous mining claims. Mining was limited until the arrival of the railroad. In the latter part of the nineteenth century, gold fever was spreading throughout the West. The exposure of so many rock formations and fault zones in the canyon led some to believe that precious metals could be easily found. In reality, high grade asbestos, copper, silver, lead, and more recently, uranium ores and bat guano were located, but the logistical problems of building and stocking mining camps and of transporting the ore to the rim made mining attempts economically unfeasible. By the park's inception in 1919, all mining except at private inholdings and the Orphan Mine near Grand Canyon Village had ceased.

Evidence of these ventures is still very

visible in the park. Examples are found in Asbestos Canyon, Copper Canyon, Shinumo Gardens, Point Sublime, Hakatai Canyon, Horseshoe Mesa and Red Canyon. Evidence consists of trail and masonry work along access routes, mine adits and tailings, masonry and wooden cabins, tent floors, grinders, sawed-off shovels and other tools and human refuse. The roads and trails these early miners and settlers established formed the backbone of today's circulation systems at Grand Canyon.

Many of the prospectors turned to tourism as a more effective way to make money. John Hance's cabin near Grandview became the nucleus of a tent camp hotel, the first tourist facility at the Grand Canyon. It was located at the terminus of the Flagstaff-Grand Canyon stage line. The Grandview Hotel, the first hotel constructed on the rim, was built in 1897, and replaced a cabin used by miners from Horseshoe Mesa. In 1906, Martin Buggeln constructed a large frame hotel beside the old Hance tent hotel. These structures were razed over a span of several decades, from the late 1920's through the 1960's, when the NPS removed the few remaining structures. For a time, these hotels, the Grandview Trail down to Horseshoe Mesa, and the river, were the center of tourist activity in the park.

A more remote, but no less interesting area, was that of Bass Camp established by W.W. Bass in 1890. He built a trail to the river and located several mineral claims, but his primary goal was to show the canyon to as many people as possible. He built a road to the canyon from Ash Fork and ran a stage, guiding tourists from both there and Williams. The foundations of some of the buildings, the tramway, and the trash dumps of the camp are still visible. (Need something on Boucher here)

Railroad Development - 1901 to

1940: To increase ridership on its cross-country trains, the nation's major railroad companies began to promote the great natural wonders and National Parks of the American West for tourism. The arrival of the Santa Fe Railroad in 1901 shifted the primary tourist focus to the area of the South Rim near the Bright Angel Trailhead. The Santa Fe Railroad Station (Grand Canyon Depot) was unique among railroad stations in its log construction and rustic design. The Bright Angel Hotel was begun as a tent camp by J.W. Thurber, a stage operator who extended the stage route from Hance's Motel to Bright Angel Canyon in 1895. Probably the first person to build in this area was "Bucky" O'Neill, the journalist, mayor, sheriff, soldier and promoter who was also fond of the canyon. His log cabin is the oldest surviving structure on the rim. Ralph Cameron, another early canyon entrepreneur, moved a cabin to the area and added a porch and second story in 1902, naming it the Cameron Hotel. Development of tourist facilities by the Fred Harvey Company in conjunction with the Santa Fe Railway began during this time. The El Tovar Hotel and Hopi House curio shop were completed in 1905. Entrepreneurs such as the Kolb Brothers and Verkamp constructed what are now few remaining examples of a **pioneer/vernacular style structures**. The Fred Harvey Company and Santa Fe Railroad used **Rustic, Swiss Rustic and Ethno-Historic Styles** of architectures to evoke romantic images of pioneer construction and the rustic character of the western frontier.

Mary Elizabeth Jane Colter designed the Hopi House as a replication of structures indigenous to the Hopi mesas east of the canyon. She then designed both Lookout Studio and the Hermits Rest concession building to blend with natural rock formations in the true spirit of rustic

architecture. Ironically, but perhaps an expression of the politics of the time, the Lookout Studio obscures the views fo Kolb Studio.

Federal Administration: From 1905 until 1916, the United States Forest Service administered the Grand Canyon area. Even though it developed a townsite plan, very little development was completed until after the area became Grand Canyon National Park in 1919. The National Park Service (NPS) Landscape Engineering Department developed its own town site plan and, working closely with the Santa Fe Railway and Fred Harvey Company, expanded the visitor and administration facilities in the park over the next two decades. Grand Canyon Village is one of the earliest, most ambitious and most significant examples of 1920's American Town Planning, and a very significant cultural landscape.

During the early 1900s, administration, housing, and maintenance facilities were constructed by both the NPS and the concessioner. Stephen Mather addressed the issue of development in National Parks as follows:

"...In the construction of roads, trails, buildings and other improvements, particular attention must be devoted always to the harmonizing of these improvements with the landscape..."

Most of the buildings constructed during this development period are still standing and many are being used for their originally designed purpose. They were constructed in what is now referred to as "NPS Rustic" style, although many were designed by concession architects. The Grand Canyon Village Historic District includes many of these structures, though the district has more structures built by the Fred Harvey Company

during these years than by the NPS.

The park development changed from a tourist trade based on railroad transportation to one based on the automobile in the late 1920s. Even though the Depression caused a decline in park visitation, it was short-lived and the need for continued facilities development existed. In 1935, the Bright Angel Lodge complex, designed by Mary Colter, was completed.

By this time the Fred Harvey Company had developed tourist facilities in the bottom of the canyon at Phantom Ranch. She designed not only the structures but carefully planned the siting and location of the buildings in relation to each other. These buildings inspired other architects working at the park.

The Union Pacific Railway, at the urging of the National Park Service, had developed facilities on the North Rim at Bright Angel Point. These buildings, the North Rim Inn, and the NPS Headquarters area, their architectural style and the way in which they were sited on the landscape followed the same rustic tradition.

The Ranger Station Complex at Tuweep provided not only a functional home in a remote location, but also continued the rustic architectural standard as a romantic welcome to adventurous visitors who arrived there.

CCC: In the mid 1930s the NPS used assistance from the Civilian Conservation Corps (CCC) to maintain and expand visitor related facilities. Projects involving the CCC were integrated within the canyon at places like Indian Garden and Phantom Ranch, as well as in the developed areas on both the North and South Rims, with four CCC camps focusing on the projects such as road and trail building, erosion control, fire protection and building construction. Most

of the development in Grand Canyon National Park between 1933 and 1941 was the direct result of the Civilian Conservation Corps labor. The oral history of this significant time period in Grand Canyon's history must be collected while there are CCC workers still with us.

Trails, canyon overlooks, roads, retaining walls, monuments and structures all established a design pattern and language throughout the park. CCC programs influence the NPS and further refined and institutionalized the concepts of NPS Rustic Architecture. In 1935, NPS architect Albert H. Good defined the style as follows:

"...Successfully handled, it is a style which, through the avoidance of rigid, straight lines, and over-sophistication, gives the feeling of having been executed by pioneer craftsmen with limited hand tools. It thus achieves sympathy with natural surroundings and with the past..."

Arno B. Cammerer, Director of the National Park Service in 1935, stated a similar design philosophy during this period:

"...In any area in which the preservation of the beauty of nature is a primary purpose, every modification of the natural alndscape, whether it be by construction of a road or erection of a shelter, is an intrusion. A basic objective of those who are entrusted with development of these areas for the human uses for which they are established, is, it seems to me, to hold these intrusions to a minimum and so to design them that, besides being attractive to look upon, they appear to belong to and be part of their settings..."

HISTORIC PROPERTIES

Over 450 historic structures, most representative of NPS Rustic architecture, were designed and built between 1900 and 1940. These varied cultural resources illustrate the general historic development of the American West. More than that, they represent human exploitation, adaptation, and finally, recreation in an extremely rugged and diverse environment. **Cultural landscapes** which define the context and setting for these structures have often been overlooked as cultural resources, but are very critical to the integrity of the districts. The Grand Canyon Village on the South Rim has great potential for National Landmark status. Overlooks, trails and roads constructed by the CCC illustrate excellent examples of development for recreational purposes at Grand Canyon during the 1930's and are significant cultural landscapes. Sixteen cultural landscape areas have been identified.

At present, five historic districts, two prehistoric sites and one individual structure are listed on the National Register of Historic Places. The park's historic properties include 124 buildings listed as National Landmarks, 164 listed on the National Register Of Historic Places and an additional 165 pending nominations. The List of Classified Structures is currently being updated by the Western Regional Office. In 1983 the entire park was determined eligible by the State Historic Preservation Officer as an archeological multiple resource area. Historic properties listed on the National Register of Historic Places as well as those that are under evaluation (Appendix XXXX).

Many of the historic properties in the park are worthy of preservation. In most cases, the significance of an individual building is based on architectural style, association with master designers, technical (engineering) qualities, or associations with broad patterns

of history. As a whole, the historic properties at Grand Canyon National Park may have national significance for their use as a model of park development. The integrity of the sites and buildings makes the area useful in interpreting land use and history which is of local, regional and national significance.

Issues Related to Historic Properties

Lack of a Preservation Program: The biggest threat to historic properties (structures and landscapes) concerns the lack of a strong preservation program. The inherent lack of baseline information, inventory and understanding of these structures and landscapes leads to an unclear direction for use and preservation practices. The lack of a comprehensive, systematic, programmatic approach to rehabilitation, reuse, maintenance, and emergency repair is the biggest threat to these properties. Currently, there is no professional expertise on staff as a position to address these issues.

For this reason, the park uses an approach which only responds to other urgent or priority programs (i.e., crisis management). Life/safety and accessibility issues, Integrated Pest Management (IPM) issues, increased visitation, lead abatement and asbestos removal, the Housing Initiative and other urgent programs are driving and defining the direction or, rather, the lack of direction of historic properties preservation.

Lack of Funding: There is funding for many of these projects, along with any compliance associated with them. Funding for planning, design and construction is available for the current GMP and Federal Highways projects, for example. However, there is currently no available funding to inventory and evaluate any historic properties

implicated in the changes these projects may propose. There is no provision to develop HSR's or CLR's for these properties within the budget and schedules of the GMP and FHWA projects. As a result, until the properties can be evaluated, all features and elements are considered significant, until proven otherwise, which may thwart proposed changes. This is a piece-meal and crisis-driven approach to preserving these properties. Responding to Section 106 of the NHPA requirements prior to a developments project is not considered "preservation".

Internal Threats: Incremental direct and indirect changes due to human-caused impacts and changes are also a tremendous threat to these properties. Increased visitation has caused trampling of cultural landscapes. The incremental degradation of vegetation, walls, walkways, structures and site features have caused eyesores and safety hazards. Both NPS and concessioners continue to express the need for immediate treatment to "beautify" these areas. In some cases, such proposed treatments have preceded any evaluation and character-defining features may have been lost. Various concessioners often have ideas, needs and available funding to address those needs within their budgetary time period. Compliance for these disjointed agendas is reactionary and frustrating for the compliance staff as well as the DSC and concession staff.

Preventative maintenance of cultural resources is an unfunded element at Grand Canyon. There is no preservation crew or preservation specialist. The park maintenance staff is already understaffed and underfunded and cannot attend to the preservation of these properties.

Lack of Understanding: Finally, there is a lack of understanding of the value and significance of these resources. A strong

educational and interpretation effort for not only visitors, but also for staff is imperative for any preservation program to work.

COLLECTIONS

The goals of the museum collection are to gather and protect objects and specimens which are representative of the cultural and natural history resources of the park and which contribute to the understanding and interpretation of the park. The collections is comprised of over 230,000 cultural and natural history objects. They are divided into six major subcategories: biology, paleontology, geology, history, archeology, and ethnology. Over 1000 people use the collection each year including park staff, researchers, and publishing companies.

History: Throughout the 1920's and 1930's, the park naturalists collected materials that form the basis of the current collections. The intent was to preserve representative specimens of all areas of the park. At this time, the function of the collection was also to serve as a learning tools for park employees and as the basis for exhibitry. While the collections still serve as primary tools for interpreters, the exhibitry function has declined. With the nature of the park's small museums and limited exhibit space, the collections have become research-oriented rather than exhibit-oriented. During this period of collecting, the park viewed itself as a natural area, and collector tended to ignore historical objects.

Once the orientation toward research began, collections with specific interests were conducted. Some of these collections have become part of the park research collections. Others are housed with the research institution; these have not been cataloged into the National Catalog System in use in the park. At the time some of the research

was conducted, collection permits were not required. The research institutions in some cases may be unaware of the NPS ownership of the materials.

While all collections have inherent value due to the objects they contain, the collections at Grand Canyon National Park have an intangible value due to the national prominence of some of the collectors/donors. A partial list of these donors includes Marian Albright, Bruce Babbitt, Stephen Booth, Ferdinand Burgdorff, J. Harvey Butchart, Mary E. Jane Colter, Barry Goldwater, Marguerite Henry, Francois Mathes, John H. Maxson, Nicholas Roosevelt, Clyde Searl, John Wetherill, and David White.

Issues Related to the Museum Collection:

Problems with the collection deal with storage, information and staffing needs. There is insufficient staff to properly catalog, provide access to and care for the collection.

In recent years, historical and archeological objects are being collected to protect them. Increase in use of the backcountry has increased the opportunity for vandalism. Proper storage for all of these materials does not exist. Although the research collections have continually grown, the 1960's saw a decrease in staffing and storage space. For much of that decade, the collections were simply maintained while work and storage area were restricted by fifty percent. What had been barely adequate up to that time is being utilized now when two or three times the space is needed. Cabinets are double-stacked so that work space once available does not exist. This storage does not meet museum or NPS standards. Fire, security, vandalism and object deterioration due to lack of climate control are all critical issues threatening the collection. historic properties preservation, historic resource studies,

archeology preservation and interpretation are only some of the programs which would be severely affected were these objects and this collection lost.

Data important to many programs is not utilized because it is not accessible due to lack of cataloging. Because of the simple maintenance of the collections during the 1960's, many objects were received that have not been cataloged into the National Catalog System. Recently, this system was revised. Most of the objects currently cataloged are in the old system. Only the last 3,000 are cataloged into the new system. At this time, no requirements exist demanding the re-cataloging of objects from the old system into the new. However, computerization of the National System will mandate such a procedure. Further, at this time very little photographic documentation of the research collection exists. In addition, it is just as important to have an active program to document today's projects and events, so as to record these in the museum collection for future generations.

Another element of the research collections is the park photographic collection which contains an important visual record of park developments. In order to conduct inventories and evaluations of historic properties, these photographs must be easily accessible.

Lack of knowledge of other sources of information, research work, etc., does not provide for efficient use of limited research work efforts. For example, without a thorough knowledge and copies of previous research work, efforts may be duplicated by current researchers. They would simply be unaware of preexisting work. The depth of the information available through the museum and library collections could be greatly increased by gathering information on sources of Grand Canyon material outside the

park as well as through such means as collecting oral histories. The more data available to researchers and park management will help to increase the quality of projects being completed as well as to provide better understanding of past events which may help develop better solutions for future needs.

Summary of Historical and Curatorial Resource Related Issues:

1. Lack of information on the park's history, cultural and natural resources within the park, and information and resources in non-park facilities.
2. Inadequate staffing and funding for park resource management staff, as well as for specialized work such as preservation crews, training, preventative maintenance, etc.
3. Lack of computerization: lack of protocol standards and databases, need for integration of cultural resource data in GIS, need for data sharing in and out of park, etc.
4. Lack of systematic, programmatic, approach to rehab, reuse, maintenance, and emergency repair of historic structures and cultural landscapes with the associated potential loss of integrity/character.
5. Inadequate care and preservation of the park's museum collections.
6. Inadequate park protocol for disposition of research material and documentation gathered during projects
7. Programs which cause rapid changes affecting the character-defining features of cultural landscape and

structures without adequate concern
for these resources.

CULTURAL CONTEXT/THEME

In 1985, the Park Historical Architect and Cultural Resources Management Specialist developed a very useful matrix which accomplished the following: it evaluated each historic structure in the context of all potentially applicable themes. Also, levels of significance were assigned. This matrix was used in the last version of the Grand Canyon Resource Management Plan (RMP), written in 1987.

Since this plan was finalized, also in 1987, a new set of categories for themes have been published in the 1987 version of the History and Prehistory in the National Park System and the National Historic Landmarks Program, or "the yellow book". The themes identified by the former Park Historical Architect in the last RMP no longer apply. This posed an enormous void in this section of this RMP revision.

Within the Historic Structures Program chapter of this RMP, is a description for the need of such a study, and a project statement for the development of a revised version of this matrix has been proposed. Because of the lack of historical preservation expertise on staff at Grand Canyon, this matrix may need to be accomplished with the assistance of the Western Regional Historic Preservation Staff.

Natural Resource Baseline Information

NATURAL RESOURCES INVENTORY AND MONITORING

Recommended minimal set of natural resources information which should be available in all natural resource parks (NPS-75):

TABLE 2-1		MINIMUM STANDARDS NPS-75		
		MEETING	EXCEEDING	NOT MEETING
MINIMUM AVAILABLE NATURAL RESOURCES INFORMATION				
HISTORICAL DATABASE				
a.	Collection of historical scientific material stored at the park:			
	Rare event records			X
	Maps			X
	Photographs			X
	Manuscripts			X
	Specimen Collections			X
b.	Automated bibliography of documents regarding park resources:			
	Extended search for published and unpublished documents			X
	Incorporation into an automated program			X
	Establishment of procedures for maintaining currency			X
SPECIES INFORMATION				
a.	Lists of the following biota identified as occurring in the park:			

TABLE 2-1		MINIMUM STANDARDS NPS-75		
MINIMUM AVAILABLE NATURAL RESOURCES INFORMATION		MEETING	EXCEEDING	NOT MEETING
Vascular plants				X
Vertebrate animals				X
Federal/State T&E Species		X		
Species of special concern		X		
b. Surveys to confirm occurrence & to discover new species of:				
Vascular plants				X
Vertebrate animals				X
Federal/State T&E Species				X
Species of special concern				X
c. Species status and distribution information for:				
Federal/State T&E Species				X
Species of special concern				X
DIGITAL MAPS OF VEGETATION ASSOCIATION IN THE PARK AND ENVIRONS				
Maps		X		
DIGITAL CARTOGRAPHIC DATA				
Digital elevation models/digital line graphs (DEM/DLGs) of:		X		

TABLE 2-1		MINIMUM STANDARDS NPS-75		
MINIMUM AVAILABLE NATURAL RESOURCES INFORMATION		MEETING	EXCEEDING	NOT MEETING
Hydrography		X		
Hypsography		X		
Boundaries		X		
Transportation		X		
DIGITAL SOILS MAPS				
SCS "Order 3" surveys				X
Detailed surveys				X
DIGITAL GEOLOGY MAPS				
Bedrock				X
Surficial				X
WATER RESOURCES INVENTORY				
a. Locations (include digital cartographic information) of:		X		
Streams		X		
Lakes		X		
Wetlands				X
Groundwater (hot springs, cold springs)				X
b. Water quality use classifications		X		

TABLE 2-1		MINIMUM STANDARDS NPS-75		
MINIMUM AVAILABLE NATURAL RESOURCES INFORMATION		MEETING	EXCEEDING	NOT MEETING
WATER CHEMISTRY FOR KEY WATER BODIES				
Alkalinity		X		
pH		X		
Conductivity		X		
Dissolved oxygen		X		
Rapid bioassessment baseline (EPA/State Protocols, involving fish and macroinvertebrates)				X
Temperature		X		
Flow				X
Other constituents where important as determined on a case-by-case basis:				
Toxic elements				X
Clarity/turbidity		X		
Nitrate/Nitrogen				X
Phosphate/Phosphorus				X
Chlorophyll				X
Sulfates				X

TABLE 2-1		MINIMUM STANDARDS NPS-75		
MINIMUM AVAILABLE NATURAL RESOURCES INFORMATION		MEETING	EXCEEDING	NOT MEETING
Bacteria				X

TABLE 2-1		MINIMUM STANDARDS NPS-75		
MINIMUM AVAILABLE NATURAL RESOURCES INFORMATION		MEETING	EXCEEDING	NOT MEETING
LOCATION OF EXISTING NEARBY AMBIENT AIR QUALITY MONITORING STATIONS AND SOURCES				
LIST OF:				
Air quality-related values		X		
Visibility goal		X		
PRECIPITATION AND METEOROLOGICAL DATA				
Precipitation amount		X		
Relative humidity		X		
Wind speed and direction		X		
Maximum and minimum air temperature (daily)		X		

NATURAL RESOURCES INVENTORY AND MONITORING

SUGGESTED PARAMETERS FOR BIOLOGICAL INVENTORY AND MONITORING (NPS-75)

SUGGESTED PARAMETERS FOR BIOLOGICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETIN G
HISTORICAL DATABASE			
Rare event records			X
Bibliography of all resource descriptive documents			X
Collection of manuscripts, old maps, photos, etc.			X
GIS and related maps			X
SPECIES			
Gather species lists for vascular plants & vertebrate animals	X		
Inventory of vascular plants including distribution			X
Inventory of mammals, birds, fish, amphibians, & reptiles, incl. distribution			X
Inventory of other species of special interest (e.g. sensitive to air pollution)			X
Listing of species that are threatened, endangered, endemic or non-native			X

TABLE 2-2

SUGGESTED PARAMETERS FOR BIOLOGICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETIN G
Distribution maps of plant and animal species of special interest			X
Inventory of invertebrates and non-vascular plants			X
POPULATIONS			
For selected species:			X
Distribution			X
Population size (incl. density/cover if appropriate)			X
Age/stage/size class structure			X
Growth/recruitment/productivity/mortality			X
Population genetics			X
COMMUNITIES			
Vegetation/land cover map	X		
Community structure			X
Species composition			X
Important abiotic components associated with sample plots			X
ECOSYSTEMS			

TABLE 2-2 SUGGESTED PARAMETERS FOR BIOLOGICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETIN G
Important nutrient pools			X
Decomposition			X
Biomass (living and dead)			X
Productivity			X
Energy flow			X
INTEGRATION			
Qualitative community descriptions to correspond with vegetation map			X
Landscape patterns (e.g., fragmentation, corridors)			X
Population models for species of special interest			X
Quantitative descriptions			X
population dynamics			X
trophic relationships			X
changes in species composition			X
community dynamics			X
Community models from population models			X

TABLE 2-2

SUGGESTED PARAMETERS FOR BIOLOGICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETIN G
Nutrient cycling models			X
Ecosystem models			X
GEOGRAPHY			
Determination of study area and location of resources associated with an appropriate base map series and coordinate system			
Resources mapped accurately to GIS standards			X
Accurate and comprehensive representation of park landscape (e.g., satellite, aerial photography, survey as appropriate)			
Digital GIS data base as appropriate (using consistent and stable base)			X

NATURAL RESOURCES INVENTORY AND MONITORING

Suggested Parameters for Geophysical and Chemical Inventory and Monitoring

TABLE 2-3		MINIMUM STANDARDS NPS-75		
SUGGESTED PARAMETERS FOR GEOPHYSICAL & CHEMICAL INVENTORY & MONITORING		MEETING	EXCEEDING	NOT MEETING
GEOLOGY				
Maps at reconnaissance level				
Geologic maps (bed rock and surficial)		X		
Special purpose maps showing:				
Geologic hazards (e.g., floodplain, features)				X
Channels and channel characteristics				X
Other special purpose maps				X
Soil maps				X
Physical geology, mineralogy and soils				
Soil analysis (organic content, water holding characteristics, mechanical analysis, physical analysis, radon flux, water erodibility (index), infiltration rate, soil productivity (composite index), cation exchange)				X

TABLE 2-3

SUGGESTED PARAMETERS FOR GEOPHYSICAL & CHEMICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETING
Principle mineral composition of geological units (same scale as bed rock geology)			X
Geo-hazards			X
HYDROLOGY			
Watershed maps/delineation			X
Special purpose maps			
Groundwater (water table)			X
Bathymetry			X
Other			X
Location and Classification			
Streams			X
Lakes			X
Wetlands			X
Groundwater (hot springs, cold springs)			X
Physical parameters			
Temperature			

TABLE 2-3

SUGGESTED PARAMETERS FOR GEOPHYSICAL & CHEMICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETING
Stream (monthly)			X
Lakes (seasonally)			X
Wetlands (seasonally)			X
Groundwater (seasonally)			X
Turbidity			
Streams (episodically)			X
Lakes			X
Wetlands			X
Discharge			
Streams			X
Lakes (in and out flow)			X
Wetlands			X
Springs			X

TABLE 2-3

SUGGESTED PARAMETERS FOR GEOPHYSICAL & CHEMICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETING
METEOROLOGY (Rainfall amount, Snow amount, Temperature (2 meter agl), Temperature difference (between 10 m and 2 m agl), Relative humidity, Wind speed, Wind direction, Solar radiation, Fog or cloud emersion time, Surface wetness, Fuel moisture, Soil moisture, Mixing height)	X		
UV-B Radiation (Global Climate Change Related)			
WATER CHEMISTRY (Alkalinity, pH, Conductivity, SO ₄ =, PO ₄ , Total P, Cl, Total N, NO ₃ +, NH ₄ , K+, Na+++, Ca+++, Mg+++, SO ₂ , CO ₂ , O ₃ , SiO ₂ , Coliform & fecal strep, DO, DOC, CO ₃ , HCO ₃ , HNO ₃ NH ₃ NO _x , Trace Metals)			X
AQUATIC BIO-MONITORING			X
AIR QUALITY			
General characteristic	X		
Existing Nearby Emission Sources (and non-attainment areas)	X		
Existing Nearby Ambient Monitoring Locations	X		
Air quality Related Values	X		
Atmospheric gases (SO ₂ , O ₃ , NO/NO ₂ , CO, HNO ₃ , Non-methane Organics (NMOCs), Total & Speciated, CO ₂ , N ₂ O, CH ₄ , CFCs, Total Organic Chlorine)			X

TABLE 2-3

SUGGESTED PARAMETERS FOR GEOPHYSICAL & CHEMICAL INVENTORY & MONITORING	MINIMUM STANDARDS NPS-75		
	MEETING	EXCEEDING	NOT MEETING
Atmospheric particulates (S) ₄ , NO ₃ -, H +, NH ₄ +, Ca + +, Mg + +, Pesticides, Trace Metals (Na-Pb), Carbon (Elemental & Organic), Aerosol Acidity)	X		
Wet Deposition			
Precipitation, Rain and Snow (Alkalinity/Acidity, pH, Conductivity, SO ₄ =, NO ₃ -, PO ₄ +, Cl-, NH ₄ +, Ca + +, K +, Na +, Mg + +, Peroxides, Pesticides, Trace Metals, Organic Anions)	X		
Cloud/Fog (SO ₄ =, NO ₃ -, H +, NH ₄ +, Peroxides)			X
Visibility			
Atmospheric Extinction (b _{ext})	X		
Atmospheric Scattering (b _{scat})			X
View	X		

CULTURAL RESOURCE BASELINE INFORMATION

CULTURAL RESOURCE DOCUMENTATION CHECKLIST			
TITLE	CURRENT OR APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
PLANNING DOCUMENTS			
Preauthorization and Authorization			
Statement for Management	X		
Outline of Planning Requirements	X		
General Management Plan		X	
Development Concept Plan		X	
Resources Management Plan		X	
Interpretive Prospectus		X	
SERVICEWIDE INVENTORIES, LISTS, CATALOGS, AND REGISTERS			
Cultural Resources Bibliography		X	
Cultural Sites Inventory			X
List of Classified Structures		X	
National Catalog of Museum Objects		X	
National Register of Historic Places		X	
BASIC CULTURAL RESOURCE DOCUMENTS			
Archeological Overview and Assessment	X		
Archeological Identification Studies			X
Archeological Evaluation Studies			X
Ethnographic Overview & Assessment			X
Ethnographic Oral Histories & Life Histories		X	
Ethnographic Program			X

CULTURAL RESOURCE DOCUMENTATION CHECKLIST			
TITLE	CURRENT OR APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
Historical Base Map		X	
(con't) Historical Resource Study (HRS)			X
Park Administrative History			X
Scope of Collection Statement	X		
SPECIAL RESOURCE STUDIES AND PLANS			
Archeological & Ethno. Collections Studies			X
Archeological Data Recovery Studies			X
Collection Management Plan			X
Collection Storage Plan	X		
Collection Condition Survey			X
Cultural Landscape Report			X
Ethnohistory			X
Exhibit Plan		X	
Historic Furnishings Report			X
Historic Structure Preservation Guide (HSPG)			X
Historic Structure Report			X
Social Impact Study			X
Special History Study			X
Traditional Use Study			X

SUMMARY CHART FOR ARCHEOLOGICAL SITES												
SIGNIFICANCE	CONDITION					IMPACTS				DOCUMENTATION		
	Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National												
State & Regional	2	1			1		1		1	2		
Local	1	1					1			1		
Not Evaluated	2700	420	575	35	1525		165	169 5	840	430	950	1320
TOTALS	2703	420	577	35	1526		167	169 5	841	433	950	1320

****Note:** These are approximate figures

SUMMARY CHART FOR STRUCTURES

SIGNIFICANCE		CONDITION				IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Un-known	Severe	Mod-ate	Low	Un-known	Good	Fair	Poor
National	147	120	26	--	1	1	22	123	1	108	15	24
State & Regional	57	45	11	1			37	20		1	0	56
Local	102	24	39	38	1	37	47	17	1	0	43	59
Not Evaluated	233	62	76	9	86	3	111	22	97	18	22	193
TOTALS	539	251	152	48	88	41	217	182	99	127	80	332

SUMMARY CHART FOR OBJECTS								
DOCUMENTATION (Form 10-254 Submitted to National Catalog at Harper's Ferry)	Archeology	Ethnology	History	Archives	Biology	Paleonto-logy	Geology	TOTALS
Registra- tion Data Only	0	0	0	0	0	0		
Registra- tion & Catalog Data	150,916	182	15,884	26,587	15,299	16,092	5700	230,660
Total Items Cataloged	150,916	182	15,884	26,587	15,299	16,092	5700	230,660
Backlog to be Cataloged	491	-	-	4536	1000	-	-	6027
Total Collection Summary	151,407	182	15,884	31,123	16,299	16,092	5700	236,687

SUMMARY CHART FOR OBJECTS								
CONDITION (The percentage of collection in the following categories)	Archeology	Ethnology	History	Archives	Biology	Paleonto-logy	Geology	TOTALS
Excellent	53	5	1561	2319	53	42	2	4035
Good	82947	150	7052	20036	6256	5693	251	122385
Fair	2077	0	1104	3704	1216	667	3	8771
Poor	287	0	465	528	209	11	0	1500
Unknown	65552	27	5702	0	7565	9679	5444	93969

SUMMARY CHART FOR CULTURAL LANDSCAPES											
SIGNIFICANCE	CONDITION			IMPACTS				DOCUMENTATION			
	Good	Fair	Poor	Un-known	Severe	Moderate	Low	Un-known	Good	Fair	Poor
National											
State & Regional											
Local											
Not Evaluated											
TOTALS											

(insert graphic)

Chapter Three: Resource Management Programs Overview

THE DIVISION STAFF OF RESOURCES MANAGEMENT TAKE ON THE CHALLENGE: A COMMITMENT TO EXCELLENCE

In a park as large, complex and understaffed as Grand Canyon's, it is easy to become entrenched in specific unrelated tasks and crisis management. However, the resource management division staff have met as a team to develop an overall vision which will guide them in their daily work. There is a unified momentum in such teamwork. It is the feeling among the staff that their lives and work are intertwined and moving toward a recognizable and legitimate goal. It comes from a clear vision of what the division ought to be, from a well thought out strategy to achieve that vision, and from carefully conceived and communicated directions and plans that enable everyone to participate and be publicly accountable in achieving those plans. This forms a basis and foundation for this version of the Grand Canyon National Park Resource Management Plan; a pertinent, but flexible research and action strategy program.

The mission statement for the division has been developed by the staff within the spirit of a partnership not only with each other, but with others as well. In these times of limited staffing and funding, it is critical that all employees from all divisions at Grand Canyon National Park are involved in the unified momentum provided by a common vision. In various ways, other divisions provide administrative support, dissemination of critical information, cultural and natural resource law enforcement and appropriate resource maintenance. But this partnership goes beyond even the full staff at Grand

Canyon National Park. There are many other entities within the greater ecosystem of the Colorado Plateau, of which Grand Canyon is a part. These were identified in the first chapter of this document. All of these entities are an important member within this partnership.

THE MANDATE

As National Park Service stewards of the resources at Grand Canyon, the first and foremost obligation the staff has is to fulfill the mandate of the Organic Act of 1916 that directed the National Park Service "...to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for future generations." The staff will also strive to prevent "...derogation of the values and purposes for which (national parks) have been established," in accord with the Redwoods Act of 1978. The courts have affirmed preservation of park resources, noting, "*In the Organic Act, Congress speaks of but a single purpose, namely, conservation...*" (NRA vs. Potter, 1986).

THE DIVISION

As individual program managers of various resources at Grand Canyon, each branch within the division will strive to achieve the common vision expressed by the following statements:

UNDERSTAND THE RESOURCE: Exhibit a high level of understanding of the natural resources and processes, and the cultural resources, of the Park, allowing the staff to

detect, evaluate and monitor changes in resource conditions. This knowledge will be used to make better decisions regarding resource preservation and research, land use, development and visitor use in the Park and the eco-region. These decisions should be made in a cooperative manner involving the National Park Service and its partners within the eco-region. A functional relationship with the National Biological Survey is critical to this concept.

COMMUNICATE: Clearly and concisely communicate resource management issues to policy makers and Park staff in a well-reasoned, timely and scientifically credible fashion. Use better communication techniques such as a division newsletter; staff participation in brown bag; educational & interpretive programs; articles in park Daily Report; a marketing package aimed at the Park's Management Team, Western Regional Office and other federal, state and local partners; include representatives from other divisions in Resource Management staff meetings; involvement in Grand Canyon Field Institute classes and programs; publishing in nationally recognized journals and periodicals; increased focus on communications by the Division Chief. Because of the communications effort, the Division's work will be more integrated and valued by other Divisions within the Park, and their work will be based on resource values, sensitivities and constraints.

BE PROACTIVE: Use a proactive, integrated, adaptive approach to improve natural and cultural resource management at the Park. The individual resource programs described in this chapter demonstrate this proactive approach.

HAVE GOOD BASELINE DATA: Inventory, gather, analyze, interpret and disseminate

information on Park resources. In addressing the current status of Grand Canyon's resources, it became very evident that the single biggest threat to Grand Canyon was the lack of information. Not only is information lacking as to what was threatening park resources and what the current condition of resources were, but, more importantly, the fact that there were resources left uninventoried, unaccounted for, unknown and un-monitored presented the most cryptic scenario. Sound monitoring protocols cannot be developed until the basic inventories are completed. The effects of increased visitation, internal operations and external threats are unknown. Resource Managers cannot even begin to develop management strategies until it is known what the resources are, where they are and what threatens them.

HAVE A SOUND DATA MANAGEMENT SYSTEM: Manage park resource data and collections for ready retrieval and long-term storage. Provide for the most adequate conceptual and institutional structure for data. The division's Integrated Data Management System should be improved so historical data can be re-acquired and contemporary data can be more easily utilized. Construction of new curatorial facilities should be completed,, so as not to lose what we have.

PROVIDE GUIDANCE: Assist or direct the preparation of management reports, publications and environmental impact documents through internal or multi-agency contexts. Standardize resource management procedures park-wide (river, backcountry monitoring, etc.). Develop a closer relationship with Park Divisions, especially the Canyon Subdistrict and the branch of Aviation and Fire Management.

PROVIDE COUNSEL: Provide counsel and

consultation in management policy formulation and implementation, coordinate or conduct monitoring studies to verify the results of management actions, and identify impacts which occur to the resources.

MEET LAWS, POLICIES AND MANDATES:

It is the role of this division to be aware of all regulations and legislation regarding resource management, and to ensure that they are met. Wilderness designation should be pursued, and appropriate strategies should be designed to manage for Wilderness values.

RESTORE ALTERED NATURAL SYSTEMS:

Coordinate and conduct mitigation actions associated with environmental and cultural restoration. Revise the Backcountry Management Plan and River Management Plan. Integrate the Prescribed Fire Program with the Division of Resources Management.

MAINTAIN, PROTECT AND INTERPRET CULTURAL RESOURCES:

Conduct inventories, evaluations, monitoring and select appropriate treatments which are in accordance with NPS policies, laws, guidelines and standards. Incorporate cultural resource knowledge into planning and compliance to avoid or minimize adverse effects.

LOOK OUTSIDE THE PARK

BOUNDARIES: Understand the role of resources management of Grand Canyon within the greater Colorado Plateau ecosystem. Use an inclusive, transactive perspective on resources management that will allow it to work easily and efficiently with resource managing partners: coordinate monitoring (technical) and planning; develop data sharing capabilities; develop Memorandums of Understanding and Agreement (MOU) with boundary-sharing tribes; develop external scientific review program; develop a Northern Arizona University (NAU) research protocol for

research liaison with the National Biological Survey (NBS); develop annual state-of-the-canyon report; evaluate resources with relation to the entire plateau. This partnership approach will also allow the Division to maintain awareness of regional resource issues before they begin to affect Grand Canyon National Park, and thereby prevent some management challenges.

FULFILL POTENTIAL AS CREDIBLE LEADERS IN RESOURCE MANAGEMENT:

The division will change its modes of action and its organizational structure through time, as needed, and as information collection and management methods continue to evolve. This approach will gain the Grand Canyon National Park Division of Resources Management recognition as a leader in resources management. The political and professional credibility of the Division will be markedly improved in ten years, within Grand Canyon, the eco-region, and the nation, due to more effective communications. Identify and capitalize on the strengths of current staff, identifying weaknesses and strengthen them where possible.

FILL CURRENT VACANCIES: Move a larger portion of the Division staff to Flagstaff. The division staff supports this position, which is preferable to continuing the status quo which prevents filling vacancies due to lack of housing. This scenario assumes that employee housing will be provided in Flagstaff by open market. This position is contingent on: (a) upon completion of facilities proposed in the GMP, all positions will be returned to the park or Tusayan area, (b) other park divisions follow suit, creating an interdisciplinary office in Flagstaff, (c) the Flagstaff office will have a senior supervisor and support staff, (d) a video-conference system will be used to communicate on a daily basis, (e) minimal office and bunkhouse

space will be maintained at the South Rim for occasional use by Flagstaff-based employees, adequate vehicles, computers, electronic data files and other administrative equipment will be located at the Flagstaff branch office.

INCREASE ONPS BASE FUNDING AND PURSUE OTHER FUNDING: Through a better Resource Management Plan, project statements and communication with the Western Regional office and Washington Office, increase ONPS base funding, while decreasing dependence on project funding. Other funding or outside assistance possibilities include: constituency building; local university assistance; resource management assistance from other divisions; grants; volunteer programs; etc.

The following pages describe the various natural and cultural resource management programs for Grand Canyon. Each program will express this vision.

NATURAL RESOURCE MANAGEMENT PROGRAM

The natural resource management program follows a simple process:

KNOW RESOURCE AND IDENTIFY
THREATS

INVENTORY

RESEARCH (ASSESS)

MONITOR
(UNDERSTAND RESOURCE DYNAMICS)

MANAGE RESOURCES ACCORDING TO MANAGEMENT
OBJECTIVES

EDUCATE

PROTECT

MITIGATE

RESTORE

MAINTAIN RESOURCES AT DESIRED
INTEGRITY

NATURAL RESOURCES MANAGEMENT AND RESEARCH

The division is separated into two areas; natural and cultural resources management. These sub-areas are further divided into branches which deal with the various kinds of resources in the park.

Natural Resource Management is divided into the following branches:

1. Vegetation Management
2. Wildlife Management
3. Recreation Management
4. Air Quality Management
5. Water Quality Management
6. Geologic Resource Management
7. Paleontological Resource Management
8. Cave Management
9. Geographic Information System

Six full-time positions administer these program areas and manage these resources.

Research in the park is conducted by the members of the division in the Glen Canyon Environmental Studies Office in Flagstaff and the National Biological Survey (formerly the Cooperative Park Studies Unit) at Northern Arizona University, also in Flagstaff, and outside contractors under the guidance of the Division staff.

THE PAST FIVE YEARS

For the past five years, the following projects and issues have been a focus for management activities and emphasis within natural resource management:

Glen Canyon Dam Environmental Studies:
On July 27, 1989, the Secretary Of the Interior directed the Bureau of

Reclamation (BOR) to prepare an Environmental Impact Statement (EIS) on Glen Canyon Dam operations. Since then, the branch has spent a great deal of time and emphasis on this issue, representing Grand Canyon National Park in this process.

Air Quality Program: The EPA has recently ruled that a local coal-fired power generating station reduce its sulfur emissions by 90% to protect the air quality of Grand Canyon National Park. This issue has been subject to much controversy and publicity over the past several years. The monitoring of haze over the park has been a major emphasis within this branch, with appropriate program funding from WASO.

Aircraft Overflights: The 1975 "Grand Canyon Enlargement Act" and the tragic June 1986 mid-air collision between two aerial tour operators were one of many issues that led to the signing of the 1987 "National Parks Overflight Act". Special Federal Aviation Regulation (SFAR) 50-2 created the Grand Canyon National Park Special Flight Rules Area. As part of the SFAR, flights were restricted to certain altitudes and routes. The SFAR also instituted flight-free zones to protect 45% of the park from overflights. In accordance with Congressional reporting requirements, the NPS and FAA are currently conducting research directed at evaluating overflight impacts, compliance with regulation., and whether the Congressional mandate of substantially restoring the Natural quiet has been achieved.

Threatened and Endangered Species: Two resource specialists survey and monitor

sensitive flora and fauna where a development project or prescribed management fire are proposed. Other potential impacts, such as the Glen Canyon Dam, have also been studied in terms of how they affect these protected species. Management and protection of endangered species is actively pursued as well.

Adjacent Lands and Boundary Issues:

Numerous pieces of legislation exist establishing the boundary locations for Grand Canyon National Park and the Hualapai and Navajo Indian reservations. The legal descriptions are in conflict and resolution of the location has not been reached.

Appropriate uses which promote the preservation of Grand Canyon's resource values within these boundary disputed areas are also in conflict. Only one resource specialist has collateral duty for involvement in various interagency activities involving management actions on adjacent lands such as mining, grazing, hunting, fishing, timber cutting, burro management, wildlife management, etc.

Integrated Pest Management: Due to the recent deer mouse-Hanta Virus outbreak throughout the four corners area, this issue has been a crisis at Grand Canyon. The museum at Tusayan Ruins was closed due to a health threat to employees and visitors. Ticks carrying "relapsing fever" have also presented a health threat where rodents have access to houses and structures.

Recreation: With over 40,000 visitors visiting the backcountry and 23,000 visitors floating down the Colorado River on both commercial and private river trips, visitor impact on backcountry and wilderness areas are sometimes severe. One resource specialist, in addition to other duties, monitors backcountry campsites and trails, coordinates volunteer projects to restore some impacted

recommended wilderness areas, and is currently experimenting with the removal of the immense volumes of backcountry waste by burro.

Compliance: There are many projects occurring at Grand Canyon every year. Prescribed fire management alone requires approximately 20% of this group's time in initiating, surveying and monitoring sensitive plants and animals and other resources for National Environmental Protection Act (NEPA) compliance. Development projects include an annual Federal Highways Administration (FHWA) roads and parking improvement program averaging \$3 million per year, major housing construction projects for not only NPS, but also for concessioners and cooperators, various concession projects (contact stations, laundry facilities, housing, etc.), and miscellaneous park maintenance and operation projects. Typically, each staff member of this branch are involved in NEPA compliance for all of these projects every year.

RESEARCH

The park staff located at the Glen Canyon Environmental Studies Office in Flagstaff focus on the effects of Glen Canyon Dam on the Colorado Ecosystem, including: sand bar erosion and deposition; benthic ecology; riparian vegetation; hanging gardens; birds (bald eagles and waterfowl); and the effects of flows on the size and number of campsites in the river corridor. There are currently 3 temporary employees working in this office, funded by the Glen Canyon Environmental Studies program.

The National Biological Survey (NBS) conducts research related to the Colorado Plateau Ecosystem. Their major areas of focus for Grand Canyon have been: Integrated, Long-term Ecological Monitoring; design and monitoring of such projects

involving Bald Eagles, Southwest Willow Flycatchers, Mexican Spotted Owls, avian neotropical migrant populations and endangered plants. The NBS also assists with the task of overseeing contracts related to GCES, although actual contract administration is under the resource management division.

TYPE OF NPS EMPLOYEE		FTE's OF RESOURCES WORK		
		Natural	Cultural	Total
RESEARCH SCIENTISTS (i.e. Research Grade Evaluation and Research Grant Administration Programs)		0.0	0.0	0.0
RESOURCE SPECIALISTS (e.g. 170, 190, 193, 401, 404, 430, 808, 1015, 1016, 1215, etc.)		8.6	7.0	15.6
025 PARK RANGERS- Resources Management		0.0	0.0	0.0
025 PARK RANGERS- Resources Protection		0.0	0.0	0.0
025 PARK RANGERS- Resources Interpretation		0.5	0.5	1.0
MAINTENANCE PERSONNEL		0.8	0.0	0.8
TOTAL OF ALL RESOURCES PERSONNEL		9.9	7.5	17.4
TOTAL PARK FTE (ALL PERSONNEL)	PERCENTAGE OF PARK FTE DEVOTED TO RESOURCES...	3.1%	2.4%	5.5%
317				

RESOURCE PROTECTION

The division of Visitor Protection is involved in various resource protection activities: Poaching and Natural/Cultural Resource

Theft; Backcountry and River Patrols; Frontcountry Trail patrols; Open Water Boat Control; Trespass Grazing Enforcement;

and Backcountry/Wilderness Permitting. The activities this division is involved in, however, are not included in the table above, since there is no active interdivisional program or communication.

INTERPRETATION OF NATURAL RESOURCE ISSUES

There are two FTE's within the division of Interpretation who function as a part-time liaison between that division and Resource Management. They are made aware of various natural resource related issues and become very knowledgeable in park resources, as a result of this partnership. These issues and knowledge are incorporated into Interpretive programs given park-wide by all interpreters.

A CRITICAL NEED FOR INCREASED STAFF

The natural resources management branch at Grand Canyon is desperately understaffed due to not only the need for a larger staff to adequately handle the complex issues facing the park, but also because there are vacancies which have been allowed to lapse. Currently, the natural resources side of the division is operating with only 9.9 FTE (positions). The hiring freeze has been the most immediate threat to filling these positions, but the more long term and pressing threat is the lack of housing and office space in the park to accommodate them. Even if funding were available and hiring restrictions were lifted, there is simply not enough space to house or accommodate staff if all 31 FTE's were filled.

Thirty one FTE's is not even enough to effectively manage the resources of Grand Canyon. The RMAP process (Resources Management Assessment Program) has determined that for Natural resources management alone, there should be 68.75

FTE's available at Grand Canyon. With resource protection, research, clerical, management and support staff, the grand total becomes 147.06 FTE's. To even begin to consider such staff increases, a drastic increase in office space or housing must occur, or a change in the way in which the park houses employees must occur.

Each program description in this chapter lay out the actual staffing needs and positions required. Some positions may be combined, such as a Geoscientist position for the management of geologic, water, paleontological and air resources. However, such a position must be supported by a staff in order to address many very urgent issues.

PROGRAMS FOR NATURAL RESOURCES MANAGEMENT

The following pages present a more detailed description of proposed biological, physical and research programs for Grand Canyon. They outline a logical thought process for a suitable program for each of these area. At the end of each section will be a list of project statements necessary to achieve these program goals and objectives. R-Map Allocation Tables provide information on the numbers of FTE's required to bring these programs to fruition.

Each program section can be lifted out of the looseleaf form of this Resource Management Plan, along with its list of project statements. This may prove useful for funding officials who require justification for individual project statements. This may also be suitable for use by other park employees who wish to be better acquainted with each program area. The most important reason for this format is as an overall guide for each program manager and staff to use for daily, weekly, monthly and yearly activities within the branch. Short-term and long-term goals can thus be

woven into daily activities.

Please note that each program area is structured differently. Each area, in fact, is different in its nature, its needs, and its approach. For this reason, they will be managed accordingly. The uniqueness of each program area is only strengthened by the continuity of the vision and goals described at the beginning of this chapter.

TOP TEN PRIORITY LIST FOR NATURAL RESOURCES MANAGEMENT, 1994

- | | | |
|-----|----------------|--|
| 1. | GRCA-N-010.000 | Increase Natural Resource Management Staffing |
| 2. | GRCA-N-310.201 | Detailed Hydrogeologic Assessment of South Rim Area |
| 3. | GRCA-I-100.010 | Inventory Spring, Seeps, and Riparian Vegetation |
| 4. | GRCA-N-200.101 | Inventory all Threatened, Endangered and Sensitive Species |
| 5. | GRCA-I-500.000 | Manage Cave Resources |
| 6. | GRCA-I-240.102 | Increase Participation in Interagency Cooperative Projects |
| 7. | GRCA-I-161.000 | Conduct and Integrate the Prescribed Fire Program |
| 8. | GRCA-N-201.101 | Inventory, Monitor, Manage and Protect Park Mammals |
| 9. | GRCA-I-800.001 | Backcountry Research and Monitoring |
| 10. | GRCA-I-810.002 | Rehabilitation of Wilderness Impacts |

Vegetation Management

INTRODUCTION

The vast diversity of vegetation at Grand Canyon is most likely unsurpassed by many other national parks nationwide. The Park contains three of the four North American deserts (Mojave, Great Basin, Sonoran) as well as montane ecosystems (boreal forests such as subalpine coniferous forests of spruce, fir and aspen), cold temperate forests and woodlands (ponderosa pine, pinion pine and juniper), grasslands (subalpine, plains and Great Basin), cold desert scrub, warm desert scrub and riparian woodlands/scrub.

The Park contains over 1400 known vascular plant species within an elevation difference of almost 8,000'. This information was gathered through past surveys in certain sections of the Park and herbarium specimens. A vast portion of the Park, though, namely the inner canyon, has never been surveyed. Therefore, the species list is quite incomplete. A recent survey of a small portion of the Park found 195 species of lichen. Other non-vascular plants have yet to be surveyed.

Although, Grand Canyon has a completed 1984 vegetation classification and map, there is little known about the vegetation dynamics in the park and how they are related to internal and external threats. Little is also known about the location, extent and health of threatened, endangered and sensitive plant species. An understanding of the impacts to riparian vegetation of the park, considered extremely important communities within the desert ecosystems of the inner canyon, is also unknown.

PROGRAM OBJECTIVES

NPS Management Policies state that, "*The National Park Service will seek to perpetuate*

native plant life as part of natural ecosystems (4.8)" Management policies further state that, "The National Park Service will assemble baseline inventory data describing the natural resources under its stewardship and will monitor those resources...to detect or predict changes. The resulting information will be analyzed to detect changes that may require intervention and to provide reference points for comparison with other, more altered environments (4.4)".

ISSUES AND SYSTEMWIDE ISSUE CATEGORIES

The vegetation Management program at Grand Canyon should address the following issues:

- (1) lack of baseline information on species and ecosystem dynamics (N20 Systemwide Category),
- (2) lack of baseline information on threatened, endangered and sensitive plant species (N20, N03),
- (3) disruption of the natural fire regime (N07),
- (4) effects of human activities on vegetation changes both internal and external (N18),
- (5) lack of information regarding the extent and impacts of exotic plants on the native vegetation (N20, N05) and
- (6) the need for integrated planning and consistent monitoring protocols (N20).

The issue that is most critical is that of the lack of baseline information on both species/ecosystem dynamics and also for

threatened and endangered species. The fact that there is a lack of this baseline data affects all other programs. For example, in order to provide NEPA compliance for a proposed prescribed burn area, Threatened & Endangered species must be surveyed first. This presents a very tedious and time consuming scenario when each prescribed burn area must be surveyed separately. Good baseline data will not only save time and money in the long run, it will provide a better basis for understanding the park's vegetation and lead to better management practices; approaching the program from a proactive perspective.

The condition and status of many unique riparian areas is unknown. Water withdrawal outside the park boundaries may have a negative effect on seeps and springs which feed these riparian areas

CURRENT PROGRAM

The current program for vegetation management is virtually non-existent. Approximately 1 FTE is available on staff to perform all the following tasks, each a full-time job in itself:

- surveying for sensitive plant species in areas to be disturbed by construction or fire,
- monitoring the population condition of the endangered plant, Astragalus cremnophylax var. cremnophylax,
- planning and implementing revegetation projects mostly in the river corridor when volunteers are available,
- performing small exotic plant projects when problems are discovered.

No staff is available to implement any planning, comprehensive monitoring or studies pertaining to ecosystem dynamics.

PROPOSED PROGRAM

The following matrix shows the R-MAP allocation for FTE's required to fully staff a Vegetation Management Program which could address the most compelling issues and mitigate the greatest threats to Grand Canyon's vegetation. One FTE is obviously not adequate. Only 11% of the staff is currently available to achieve the program goals and objectives outlined here.

VEGETATION MANAGEMENT	R-MAP FTE FULL ALLOCATION
Native Terrestrial Plant Mgt. & Monitoring	3.91
Native Aquatic Plant Mgt. & Monitoring	0.62
Threatened & Endangered Plant Mgt.	
Federal T & E Species	0.34

Federal Candidate 1 & 2 Species	0.56
Other Species Listed by State(s)	0.56
Exotic Plant Management	
Control	2.26
Monitoring	0.34
Reintroduction of Extirpated Plants	0.00
Subsistence Use Management - Plants	0.11
Agricultural Use Management	0.00
TOTAL FTE's	8.71

NEED FOR BASELINE INFORMATION

Endangered, Threatened and Sensitive Plant Species

Due to the wide diversity of vegetation at Grand Canyon and the unique geologic features, a relatively large amount of rare plants are known to exist. Currently there are 21 plant species known from the vicinity of Grand Canyon which are either listed or candidates for listing under the Endangered Species Act. An additional 98 species in or near the Park have been assigned special status designation by other agencies.

There is no complete database on these sensitive species. Status Reports were done for only six of the 21 plants approximately ten years ago. No work has been completed to update the status of the six plants or to

determine an initial status for the rest of the species. Surveys for such plants are only done when disturbances to possible habitat are proposed.

There is currently one known endangered plant in the Park, *Astragalus cremnophylax* var. *cremnophylax* which is endemic to the park with a population of less than 500. The plant is protected by a fence and is monitored annually. Research on the plant's reproductive needs or germination needs is lacking as is the requirements of the plant regarding such environmental factors as precipitation or soil moisture.

The goals for the Endangered, Threatened and Sensitive portion of the Vegetation Management program are:

#1 - Perpetuate the biological vegetation diversity of the park by completing an

inventory of all the endangered, threatened and sensitive species in the park. This would entail completing or updating status reports for the 21 protected or candidate species at the park.

#2 - Establish long term monitoring programs for those species most threatened in the park.

#3 - Elicit research focused on providing an understanding of reproduction, germination or environmental requirements of endangered species in the park,

#4 - Actively promote the protection of sensitive plants in all park projects.

Strategy - The main focus will be on trying to complete status reports as a means of inventorying all sensitive species. Monitoring protocols will be established for high priority species to institute long term programs. More funding will be pursued to conduct site-specific surveys of species threatened by disturbance in a more efficient manner. Research on Astragalus cremnophylax var. cremnophylax will be pursued to better understand its reproductive capabilities and germination requirement.

Species and Ecosystem Dynamics: The Need for a Long Term Vegetation Monitoring Program

Although the vegetation communities were classified for Grand Canyon in 1984, the resultant map only provided a snapshot of vegetation types for that specific project. The classification field work did not establish permanent vegetation plots in order to follow changes in composition over time. Without such a system of plots, it is unknown if the vegetation classification has become obsolete in certain park areas. Also, without such a system, changes to vegetation beyond the

range of natural variation due to internal or external sources cannot be determined.

Goals for this portion of the Vegetation Management program are:

#1 Inventory and characterize the vegetation communities of the park to develop a baseline for making scientifically sound management decisions.

#2 Conduct studies aimed at understanding ecosystem dynamics.

Strategy: A concerted effort to inventory and establish monitoring plots in park riparian zones is the most critical focus of such an overall long term monitoring program. Other priorities, in the development of such a program, are to conduct a survey of relict areas and to monitor altered landscapes parkwide.

Extent and Impacts of Exotic Plants on the Native Vegetation

There are at least 70 exotic plants known in Grand Canyon. Their extent and impact is currently not known. Although the South Rim area was inventoried about ten years ago, no other inventories have been completed to date. It is apparent that such species as Tamarisk pose a great threat to the native vegetation especially of riparian area. Hundreds of acres of native vegetation have been replaced by Tamarisk along the Colorado River and its tributaries. Many springs vital to wildlife and humans are also being invaded by the plant.

Tamarisk is just one example of many exotic plants that are currently growing at an uncontrollable rate. Others are more specific to certain regions of the park and may be more easily controlled. Currently, though,

there are no staff available to even begin a simple program of exotic plant removal.

The goals of the Exotic Plant management program are:

#1 - Gain an understanding of the extent of exotic plants in the park by conducting an inventory of exotic plants by location and amount of invasion in acres for each species.

#2 - Become proactive in the management of exotic plants by building a program and staff to eradicate certain species.

MITIGATING PAST DISRUPTION OF THE NATURAL FIRE REGIME

Fire suppression has caused extensive change in the structure and vegetation composition of native forest and shrub communities. Many of the communities are considered fire-dependent for the perpetuation of natural processes. They are adapted to frequent, low intensity fires to remove undergrowth, provide an open canopy and good germination conditions for the native plants associated with these communities. Fire suppression has eliminated the opportunity for such low intensity fires in most areas of the park. Unburned fuels due to fire suppression have accumulated to unsafe levels where wildfire threatens entire forest stands and endangers developed areas in the park. During the past twenty years, the park has accomplished less than 13% of the projected area to be treated by prescribed fire. The remaining 87% involves significant complexity, much of it without precedent to the National Park Service.

There is a very serious need to manage fuels and vegetation in and adjacent to the developed areas of the park due to the significant threat to life, property and

ecosystem integrity because of the fuel levels that have allowed to build over eighty years of fire suppression. Also on the North Rim it is important to expand the prescribed natural fire zone into a larger portion of the proposed wilderness in order to return a natural fire regime. This may take decades to achieve because several large and complex management ignited prescribed fires must be executed near these areas, in order to reduce hazard fuel loads and restore natural forest stand composition and structure.

Only limited scientific research has been completed to support the goals and objectives of the fire management program. There is a very significant need for better information concerning the role of fire in natural and altered ecological systems in the park.

There is also a strong need for integrated planning between the Branch of Aviation and Fire Management and the Division of Resources Management to ensure that park resources are managed professionally and that environmental and cultural resource compliance are adequately met.

The following goals are specific to the fire management program.

- #1. Build up the prescribed fire program to efficiently complete hazard fuel reduction needs on a more timely basis.
- #2. Increase the breadth of the fire effects monitoring program and fire-related research.
- #3. Integrate the planning efforts between park divisions.
- #4. Focus on the management, using prescribed fire or mechanical removal, of hazard fuels in and adjacent to the

developed areas of the park.

- #5. Work towards further expansion of the current prescribed natural fire zone into a larger portion of the proposed North Rim Wilderness.

Strategy - Work towards integrating the Division of Resource Management more closely with the Wildland Fire program by increasing funding and staff time to devote to adequate data collection regarding threatened and endangered species and cultural resources. Obtain funding to increase the scope of the Fire Effects Monitoring program and complete fire history studies to provide a better scientific basis for fire management objectives.

MITIGATING EFFECTS OF HUMAN ACTIVITIES ON VEGETATION CHANGES

Because of the enormous amount of visitation to Grand Canyon's rims and also its backcountry the effects of trampling, social trailing, parking of vehicles and construction on native vegetation is often dramatic. Along the South Rim in the area of Grand Canyon Village, it is difficult to travel far without finding barren ground, root exposure of trees and social trails all due to overuse. In the heavily used portions of the backcountry and along the river corridor, erosion and vegetation removal is prominent. In such desert environs it does not take much use to create scars that can take decades to heal due to the fragile make up of soils and the sensitivity of desert vegetation to trampling. Because of these there are hundreds of areas on the rim and in the canyon needing active restoration and revegetation in order to return them to their natural states.

The Glen Canyon Dam poses another type of

problem on the vegetation of the river corridor. Because flows have been controlled, an altered riparian system has emerged that promotes exotics over natives and has created altered vegetation communities in the old high water zone. Restoring the vegetation of the river corridor to a more natural state is an enormous task that must be addressed.

The current restoration program can only coordinate volunteers to assist with one or two projects per year. At this rate, the success of such a program is hard to determine since the bulk of impacted area remains. Those areas that do get rehabilitated do not have an adequate program of evaluation to determine if techniques used are working in the long term. There are no planning documents that lay out strategies for restoration on a parkwide basis.

The goals for the Rehabilitation/Restoration section of the programs are:

#1 - Complete planning documents that provide guidance for rehabilitation projects parkwide as well as provide site specific protocols.

#2 - Develop a comprehensive program that addresses impacted areas throughout the park in both the backcountry, proposed wilderness and in developed areas.

#3 - Develop a program focused on restoring the Colorado River corridor to a more natural vegetative state.

#4 - Expand the native plant propagation program to be able to handle such a restoration program and develop an evaluation program to determine if propagation and restoration techniques are effective.

INTEGRATED PLANNING AND CONSISTENT MONITORING PROTOCOLS

This need has been covered throughout the discussion on the other issues. Whether the focus is exotic plant eradication or developing a long term monitoring protocol, there will also be the need for guidance in the preparation of projects. Until comprehensive planning documents can be written and adequately implemented, it will be difficult to have an active program in vegetation management. This issue provides the highest priority for the program to become a success.

PRIORITIES & PROJECT STATEMENT REFERENCES

PRIORITY #1: Inventory and Monitor species of special concern.

A. Rare, threatened and endangered species must be inventoried, monitored and protected to perpetuate biological diversity.

- #2 GRCA-N-130.00 Inventory rare, threatened and endangered plants parkwide (SENSPLAN.PS)
- #4 GRCA-N-130.01 Develop monitoring protocols for high priority species to follow population trends (PROTOCOL.PS)
- #3 GRCA-N-130.02 Conduct site-specific surveys for projects causing potential disruption to rare, threatened and endangered plants (SURVPLAN.PS)
- #1 GRCA-N-130.03 Management of Sentry Milk-Vetch, a Listed Endangered Species

B. Exotic plant species must be identified, located and eliminated where feasible.

- #1 GRCA-N-140.00 Inventory exotic plant species, parkwide (EXOTIC.PS)
- #2 GRCA-N-140.01 Rehabilitate selected wetland/riparian areas impacted by exotics (SELEWETL.PS)

C. Hazard trees must be managed to meet Western Regional Office guidelines.

- #1 GRCA-N-150.00 Continue and update the hazard tree management program (HAZARD.PS)

PRIORITY #2: Understand Native Vegetation Dynamics

A. The vegetation communities of the park must be inventoried and characterized to develop a baseline for making scientifically sound management decisions.

- #4 GRCA-N-100.00 Inventory and monitor major vegetation types parkwide (LONGVEG.PS)
- #1 GRCA-N-100.01 Inventory spring, seep and riparian/wetland vegetation (VEGSPR.PS)
- #2 GRCA-N-100.02 Conduct parkwide relict area survey (RELIC.PS)
- #3 GRCA-N-100.03 Inventory and monitor altered landscapes parkwide (IMALTER.PS)

B. The role of fire in the natural ecosystem, especially its effects on compositional changes of vegetation, must be understood.

- #1 GRCA-N-120.00 Expand fire effects research to improve the scientific basis for the fire management program (FIREFFE.PS)
- #2 GRCA-N-121.00 Expand fire history studies to develop a better understanding of the frequency of fire and the role it plays (FIREHIST.PS)

C. Ecosystem dynamics must be understood to predict long term changes in vegetation and to determine whether these changes are within natural variation or human-caused.

- #3 GRCA-N-110.00 Develop multidisciplinary studies to determine past climate change (PASTCLIM.PS)
- #1 GRCA-N-111.00 Research vegetational changes to park grasslands from historic grazing practices (HISTGRAZ.PS)
- #2 GRCA-N-112.00 Monitor and study the influence of insects and disease on native vegetation (INSECTDI.PS)

PRIORITY #3: *Manage, restore or rehabilitate native vegetation where impacted.*

A. There is a need for integrated planning documents to implement a comprehensive vegetation management program.

- #1 GRCA-N-160.00 Develop a comprehensive plan that covers all facets of vegetation management parkwide (VEGPLAN.PS)
- #2 GRCA-N-160.01 Develop site rehabilitation (action) plans that cover vegetation management in specific locations (REHABPLN.PS)
- #3 GRCA-N-161.00 Conduct and integrate the implementation of the fire management plan (FIREFMP.PS)

B. There is a need to develop a native plant propagation program to adequately provide for rehabilitation/restoration projects.

- #1 GRCA-N-180.00 Expand the native plant propagation program (NURSERY.PS)
- #2 GRCA-N-180.01 Evaluate the effectiveness of revegetation protocol and programs (REVGEEVAL.PS)

C. Once adequate planning has taken place there will be a need to conduct rehabilitation/restoration activities parkwide.

- #3 GRCA-N-170.00 Conduct rehabilitation/restoration of altered riparian systems
(REHABALT.PS)
- #2 GRCA-N-171.00 Conduct rehabilitation/restoration of altered landscapes in developed areas
(REHABDEV.PS)
- #1 GRCA-N-172.00 Establish a vegetation management crew to perform
rehabilitation/restoration projects (VEGCREW.PS)

Native Wildlife Restoration and Management Program

INTRODUCTION

Due to the wide range in elevation and habitat types the park supports a large number of different species including 58 reptiles, 287 birds, 88 mammals, numerous invertebrates and 5 native fishes.

Grand Canyon is considered by many biologist to represent a very valuable wildlife preserve due to the size of the park and the relatively unfragmented habitat resulting from the preservation policies of the park service.

PROGRAM OBJECTIVES

Management emphasis is to minimize human impacts on Natural animal population dynamics. The native animal life is defined as all animal species that as a result of Natural processes occur or occurred on lands now designate as Grand Canyon National Park

ISSUES and SYSTEMWIDE ISSUE CATEGORIES

Park wildlife are subjected to many impacts both from internal and external threats. External threats include: trespass stock grazing (N04, N19), hunting (N19), wood gathering (N19), timber harvesting (N19), developments (N24, N16), water diversion (N12), pesticides (N11, N16, N24), and introduction of exotics (N05, N04). These activities effect wildlife in a number of ways by altering habitat, determining food availability, suppressing populations, pollution of soils and water sources, and introducing exotic species which compete with native species for shelter and food.

The Glen Canyon Dam operations for example on the Colorado River have resulted in numerous introductions of exotics (N04, N05), colder water temperatures, and changed

flow regimes (N11, N12) which have resulted in the extirpation of the boneytail chub and the Colorado River Squawfish and reduced habitat for many other natives (N02, N17, N20) .

Many wildlife species migrate in and out of the park making them susceptible to adverse management activities on adjacent lands (N16, N18). This is particularly true of ungulates such as elk and deer and the animals which prey on them such as coyote, and mountain lion as well as the many birds species which are impacted by management actions in other parts of the United States, Canada and South American.

Internal threats to wildlife result from park developments (N24), introduction of exotics (N04, N05), and past fire suppression practices (N07). Fire suppression over a period of 70 years has resulted in denser more uniform plant communities reducing habitat diversity and supressing many plants and animal populations. This is particularly true in the park's forested areas where in addition to increase plant density is added heavy buildups of dead and down trees. This change in plant communities is suspected of altering the fauna composition of the area and may have contributed to the loss or severe decline of many species.

Park management of wildlife is severely handicapped by lack of adequate data on wildlife populations, their habitat needs, and an understanding of communities/ and park ecosystems (N20). Inadequate: funding, staffing and staff housing has prevented this program from being developed to the point where basic data can be collected for use in evaluating the status of the park's wildlife,

identify threats, and develop management actions to protect this valuable park resource (N24).

CURRENT PROGRAM

Currently, there is approximately one FTE is available on staff to do the following:
Integrated Pest Management; Adjacent Land Issues; Sensitive Species;

-insert information from John regarding current program (what he spend most time on)-

PROPOSED PROGRAM EMPHASIS

The following matrix shows the R-MAP allocation for FTE's required to implement a fully funded wildlife management program that would address the most compelling issues and mitigate the greatest threats. Obviously, one FTE is not adequate to implement this program. Only 13% of this proposed, fully funded program staff is currently available to meet the program needs.

WILDLIFE MANAGEMENT	R-MAP FTE ALLOCATION
Native Terrestrial Animal Management and Monitoring	2.71
Native Aquatic Animal Mgt. & Monitoring	1.02
Threatened & Endangered Animal Mgt.	
Federal T & E Species	1.02
Federal Candidate 1 & 2 Species	1.13
Other Species Listed by State(s)	0.34

Reintroduction of Extirpated Animals	0.00
Exotic Animal Management	
Control	0.00
Monitoring	0.56
Native Animal Species Population Mgt.	0.45
Bear Management	0.00
Hunted & Trapped Species Mgt.	0.00
Subsistence Use Management- Animals	0.00
Fisheries Management	0.00
TOTAL FTE'S	7.68

WILDLIFE MANAGEMENT PROGRAM EMPHASIS

-JOHN! COULD YOU PLEASE GIVE ME A PRIORITY HERE...WE EVENTUALLY NEED TO PRIORITIZE PROJECT STATEMENTS, TOO....JUST PUT # AND BRIEF COMMENTS IF NECESSARY- THANKS!

GOAL: Preserve and protect the park's wildlife populations and where possible restore extirpated species to park land

Objectives:

- a. Develop adequate data bases on wildlife through surveys and monitoring.
- b. Restore extirpated species.

- c. Restore natural wildlife habitat.
- d. Mitigate impacts from external threats.
- e. Develop in-depth partnerships with adjacent land managers, wildlife and resource managers and with universities and researchers.
- f. Meet federally mandated program responsibilities.
- g. Control and/or eliminate non-native species from park ecosystems.
- h. Mitigate impacts to wildlife resulting from urbanization.
- i. Fully Implement Integrated Pest Management Program

Strategy 1: *N200.100 Assess the Status of Threatened and Endangered Wildlife and other Sensitive Species and Manage for Their*

Protection. To provide adequate protection for listed species a basic survey needs to be made to determine their presence or absence on park lands. Survey data along with research from other areas will be used to development and implement a long term monitoring and management program .

Inventory

GRCA-N-200.101 Inventory all Threatened, Endangered, and Sensitive Species (to be written)

GRCA-N-200.102 Determination of the distribution and flow-related risk status of the endangered Kanab ambersnail.

GRCA-N-200.103 Conduct Survey of Spotted Owl Population

GRCA-N-200.104 Conduct Inventory and Assessment: SW Flycatchers.

Monitor

GRCA-N-200.201 Implement Monitoring Program for All Threatened, Endangered and Sensitive Species

GRCA-N-200.202 Monitor Cowbirds at stock use areas.

GRCA-N-200.203 Monitor SW Flycatchers

GRCA-N-200.204 Monitor Peregrine Falcon Population

GRCA-N-200.205 Manage the Humpback Chub Population.

GRCA-N-200.106 Monitor and mitigate federally listed endangered and threatened species: razorback sucker.

Mitigation

GRCA-N-200.301 Mitigate threats to T & E Species

GRCA-N-200.302 Manage Cowbirds.

GRCA-N-200.303 Determine SW Flycatchers Pop Dynamics and Genetics

GRCA-N-200.304 Evaluate the effects of altered thermal regimes on the lower aquatic trophic levels in the Colorado River ecosystem.

GRCA-N-200.305 Monitor and mitigate

federally listed endangered and threatened species: razorback sucker.

GRCA-N-200.306 Determination of need for habitat closures to protect the Vaseys Paradise Kanab ambersnail population.

GRCA-N-200.307 The autecology and genetic variability of the endangered Kanab ambersnail.

Strategy 2: N201.100 *Assess the status of park wildlife and manage for it's protection.*

We suspect that many species have declined almost to the point of extinction. Very little inventory work has been done for park wildlife. This program calls for basic inventory and assessment of wildlife species to determine what species currently exist within the park. In coordination with this inventory effort the plan calls for monitoring of key, which may be declining or may be potentially impacted from management actions such as extensive timber harvesting or road developments. Information gathered throughout monitoring of wildlife will then be utilized by park management in assessing proposed management actions and practices both within the park and on adjacent lands for development of management programs.

Inventory

GRCA-N-201.101 Inventory and Assessment of Wildlife Pop. TBW

GRCA-N-201.101 Inventory, monitor, manage, Park's mammals.

GRCA-N-201.102 Inventory and Mon. of Desert Bighorn Sheep.

GRCA-N-201.103 Inventory and Monitor Carnivores

GRCA-N-201.104 Deer and Elk Inventory and Monitoring

GRCA-N-201.105 Inventory Bat Populations

GRCA-N-201.106 Inventory, Assessment, Mon. of Invertebrates

GRCA-N-201.107 Terrestrial Invertebrate Inventory

GRCA-N-201.108 Conduct Inventory and

Assessment: to be written general for bird surveys.

GRCA-N-201.109 Inventory and Assessment: Raptors

GRCA-N-201.110 Invent, Ass: Birds along the Colorado River Corridor.

GRCA-N-201.111 Invent and Ass: Birds of Upland, Forest, and Tributary Habitats

GRCA-N-201.112 Inventory Invertebrates at Springs, Seeps

GRCA-N-201.113 Herpetofaunal Inventory

GRCA-N-201.114 Inventory Aquatic Invertebrates.

Monitoring

GRCA-N-201.200 Monitoring

GRCA-N-201.201 Monitor Native Fish Community in the Colorado River

GRCA-N-201.203 Monitor Kaibab Squirrel Population Trends *

Mitigation

GRCA-N-201.301 Develop structure, material cycling and energy-flow models for riparian, desert, mid-elevation and rim ecosystems within GRCA.

Strategy 3: N210 Manage Integrated Pest Management Program

GRCA-N-210.101 Manage IPM Program

GRCA-N-210.102 Inventory and Manage Forest Insects and Diseases

GRCA-N-210.105 Manage Habituated/Beggar Wildlife

GRCA-N-210.103 Develop Specific IPM Plan for Grand Canyon

GRCA-N-210.104 Inventory and Monitor vectors for Human Disease

Strategy 4: N220 Extirpated Species Management Program

GRCA-N-220.001 Feasibility study for Reintroduction of River Otters

GRCA-N-220.002 Literature review on the

biology and potential for reintroduction of the extirpated Bonytail Chub.

GRCA-N-220.003 Develop a literature review on the biology and potential for reintroduction of the extirpated Colorado River Squawfish

Strategy 5: N230 Manage for Control of Exotic Species.

GRCA-N-230.101 Routes or vectors for non-native species introductions into Grand Canyon National Park.

GRCA-N-230.102 Manage Feral Burro Population.

GRCA-N-230.103 Monitor non-native fishes, mitigate impacts on natives.

Strategy 6: N240 Manage for Mitigation of External Threats

Program strategy is to develop interagency partnerships with adjacent land managers, wildlife and resource managers and with universities and researchers for the purpose of protecting the natural conditions and processes and the ecosystem integrity of lands utilized by park wildlife.

GRCA-N-240.101 Research Affects of Aircraft on Wildlife

GRCA-N-240.102 Increased Participation in Interagency Cooperative Programs

GRCA-N-240.103 Perform Cyclic Boundary Fence Maintenance

Strategy 8: N250 Mitigate impacts to wildlife resulting from urbanization.

GRCA-N-250.101 Assess Impacts of Urbanization on Wildlife

Strategy 9: Restore natural wildlife habitat.

Managing Water Resources To Restore, Preserve and Protect Natural Systems

INTRODUCTION

Managing freshwater resources of Grand Canyon National Park includes a variety of sub-disciplines. The specific water resources covered in this section of the plan relate to those waters which occur naturally in the Park (rivers, springs, seeps and ponds), and the influences upon them (both physical and cultural). Not included are those issues dealing with the biota associated with those waters (covered in the Vegetation and Wildlife sections), and domestic water supplies (although the development of domestic water sources and water disposal are covered as they impact natural waters). This is not to say that these issues do not affect the management of the Park's water resources. Rather, it indicates the scientific specialties involved in managing those aspects of water. Biological techniques are applied to floral and faunal components, while legal requirements drive domestic supply issues. The management programs outlined in this section deal with those aspects of water management that lend themselves to physical and chemical analysis, and to the legal responsibility to secure access to those waters.

PROGRAM OBJECTIVES

Under NPS policy, the overall goals of water resource management are to "*maintain, rehabilitate and perpetuate the inherent integrity of water resources and aquatic ecosystems*" (NPS 77, p. 2:48). While major watersheds in the Park originate far beyond Park boundaries (the Colorado, Little Colorado, Havasu, and Kanab watersheds), numerous drainages are contained entirely or largely within the Park (Nankoweap, Bright Angel, Shinumo, Tapeats, Spring, and Surprise are larger examples). Impacts on water resources originating outside the Park

dominate concerns for the former category, while in-Park use is the major concern regarding the latter. Given the scarcity of water in the Grand Canyon's arid environment, it is not surprising that many water sources are Traditional Cultural Properties. Consultation with affected Native American groups must be included in management of these resources. The ultimate goal of a water resource management program is to establish and preserve a natural regime in which the physical and biological components of the aquatic ecosystem function as they have evolved.

PROPOSED PROGRAM EMPHASIS

Management of water resources can be divided into six major arenas: 1) overall program management, 2) characterization of natural conditions, 3) health and safety issues, 4) wetlands protection, 5) domestic supply development, and 6) establishment of water rights. Each of these arenas is discussed below.

A preliminary assessment of staff needed to manage water resources in Grand Canyon National Park. ("RMAP Allocations", Nov. 1993) identified nearly 5 full time equivalents (FTE's). These approximations may be modified upward as more data becomes available, especially regarding impacts to springs and groundwater from domestic water development south of the Park, and to management of Glen Canyon Dam and its effect on the Colorado River in Grand Canyon. Currently, there is 1 FTE available to achieve the goals and objectives outlined in this program. The covers only 20% of the required FTE's necessary to bring this program to fruition.

WATER RESOURCES MANAGEMENT	R-MAP FTE ALLOCATION
Estuarine	0.00
Marine	0.00
Palustrine	1.24
Natural Lakes/Ponds	0.00
Rivers	0.00
Reservoirs	0.34
Springs/Groundwater	1.36
Water Rights Management	0.40
TOTAL FTE'S	4.81

GOAL #1: Characterizing Natural Conditions (N20, N10, N11, N12, N13) is vital to managing any resource. A naturally-functioning system is the ultimate goal of nearly all water management actions. To achieve this goal, those natural conditions must be quantitatively defined. In the course of condition definition, non-natural influences may also be identified. To characterize natural conditions, data must be developed on the quantity of water (including volume and seasonal variations), the chemical and biological components of the water, and the geological processes determining the character and availability of the water (groundwater dynamics, regolith, geologic environment, etc.). Because of the highly variable nature of water flow and availability in the arid

Canyon, long-term monitoring is needed to define the spectrum of natural (and human-influenced) conditions in Park waters.

1. Overall Program Management (N10, N11, N12, N13) coordinates the various studies, projects and actions needed to meet the goal of naturally functioning aquatic systems. A timely management document insures that existing information is available, needed data are developed, and issues are resolved in a prioritized manner. The vehicle used for such work is the park's Water Resource Management Plan. The Plan addresses three major categories, outlined in *NPS 77* (page 2.61)

A. **Background and authority** are the legal and policy framework upon which the water resource management program is based. In addition to

service-wide goals and objectives, Grand Canyon- specific guidance is found in the "Law of the [Colorado] River", the Grand Canyon Protection Act, the Tusayan Water Sales guidance and state adjudications.

- B. **The hydrologic environment** describes what is currently known regarding the park's water resources. Information on legal rights, the quantity and quality of park waters, and outside factors influencing the resource are covered. Not only does this section identify the extent of current knowledge, but also points out gaps in the existing data.
- C. **Water resource issues and alternatives** form the action portion of the plan. Grand Canyon faces a variety of issues, including incomplete characterization of natural conditions, threats to health and safety, preservation of Park wetlands, impacts of domestic water use, and undefined water rights.

The Water Resource Management Plan is a dynamic document, requiring periodic revisions. These revisions may be internally driven, reflecting issue changes and/or new data, or they may be externally driven by new laws or changes in surrounding land uses.

GOAL #2: Protection of Human Health and Safety (N11, N24) assume great importance when the scarcity of water at Grand Canyon is considered. Where water is available, human use congregates. Some uses, such as Inner Canyon developments, are relatively permanent, and susceptible to floods. Other uses, such as recreational use of water throughout the Canyon, are more transient and seasonal. Aquatic chemical and biological hazards influence both types of uses. Microbial hazards are biological, but

the techniques for identifying these hazards are more closely akin to chemical analyses. Consequently, microbial analysis is best carried out as an adjunct to chemical studies. A complete analysis of health and safety issues allows park management to develop options protecting permanent developments from danger, and educating recreational users on the hazards present and how to deal with them.

GOAL #3: Human Domestic Water Supply Development (N11, N12, N13, N16, N20, N24) represents one of the greatest potential impacts to the natural water regime in the central Grand Canyon. NPS policy limits water withdrawals to the minimum necessary to support the use and management of the Park, and only if such use does not significantly alter natural systems. The impacts of existing water diversions from the Bright Angel watershed, and flow augmentation of the Pipe and Coconino watersheds need to be completely defined. The impacts on groundwater flow and availability from existing and proposed wells south of the Park could have long lasting impacts on spring flow in the Canyon from the Little Colorado west to the Havasu drainages, but insufficient data are available to assess these threats. Collection of comprehensive, detailed data are necessary to determine resource damage potential from groundwater withdrawal.

GOAL #4: Establishing Water Rights (N13) preserves the Park's rights to water quantity and quality needed to maintain natural park systems. These water rights must be developed in accordance with both state and federal law. In adjudication proceedings (such as those for the Little Colorado), the NPS (through the Justice Department) must quantify its needs for the

preservation of park values. While the actual establishment of NPS water rights as discussed herein is a legal issue, it draws heavily on the results of monitoring programs carried on under characterization of natural conditions, and is augmented by findings of domestic source impacts.

Throughout all six "divisions" of the water resources management program, interpretation plays a key role. Interpreters are not limited to informing the public about specific water resources. Interpretation can also orient the public to the special needs of the Park in managing its water resources to preserve natural conditions, and how such preservation will, in turn, play a pivotal role in maintaining the Grand Canyon as a dynamic system.

GOAL #6: Wetlands (N02, N03, N10, N11, N12, N20, N24) provide some of the most biologically productive areas of the Park. Biological productivity is best evaluated and perpetuated using the tools of that science, and is discussed under the Vegetation and Wildlife sections of the report. Availability of free water makes this environment possible, and the water is subject to the same physical and legal characteristics that determine other water resource values. Indeed, water supply to wetlands is inseparable from other water supply issues, and can not be treated independently without serious duplication of effort. Therefore, the physical aspects of wetlands (water supply and delineation) are discussed under water resources, with the former integrated into the characterization of natural conditions and the latter in its own section.

PROJECT STATEMENT REFERENCE

Project Identification	Project statement numbers
Manage water resources to restore, preserve and protect natural systems	300.000
Provide overall water resource program management. (300.100 - 300.999)	
Update Water Resources Management Plan (M)	300.101
Characterize natural water resource conditions. (310.000)	
Devise a strategy for characterizing natural conditions for water resources. (310.100 - 310.199)	
Conduct research to characterize natural water resource conditions. (310.200 - 310.499)	
Conduct a detailed hydrogeologic assessment of the South Rim (#4)	310.201
Monitor water resource conditions. (310.500 - 310.799)	
Design a water resources monitoring program (#3)	310.501
Implement long-term monitoring program of water quality and quantity (M)	310.502
Interpret natural water resources. (310.900 - 310.999)	
Protect human health and safety from water related threats. (330.000)	
Provide overall planning for health and safety protection from water related threats. (330.100 - 330.199)	
Mitigate dangers to human health, safety and developments from floods. (330.200 - 330.399)	
Develop a flood contingency plan for corridor developments (M)	330.201
Mitigate threats to human health from water-borne microbes. (330.400 - 330.599)	
Monitor bacteria of the Colorado River and selected tributaries (L)	330.401

Interpret threats posed by water resources. (330.900 - 330.999)	
Protect and preserve Park wetlands. (350.000)	
Promulgate an overall wetland preservation plan. (350.100 - 350.199)	
Foster wetland-related research. (350.200 - 350.499)	
Delineate wetlands in vicinity of current and planned development areas (M)	350.201
Monitor wetland areas in the Park. (350.500 - 350.799)	
Interpret the importance and preservation of wetlands. (350.900 - 350.999)	
Ensure human water supply developments do not degrade natural conditions. (360.000)	
Ensure a broad range of options for potential water developments are available for consideration. (360.100 - 360.199)	
Identify and evaluate alternative sources of potable water; North and South Rims (M)	360.101
Develop information in support of an EIS for alternative water supplies (L)	360.102
Evaluate potential impacts from water supply developments outside the Park. (360.200 - 360.499)	
Evaluate impacts of groundwater withdrawals in the Tusayan area and further south on spring discharge below the South Rim (#1)	360.201
Develop information for a revised "Tusayan Water Sales Environmental Assessment" (L)	360.202
Evaluate potential impacts from in-Park water supply developments. (360.500 - 360.799)	
Assess impacts of current diversions from Roaring Springs (L)	360.501
Interpret human water supplies and use alternatives. (360.900 - 360.999)	
Interpret water supply and conservation (L)	360.901
Provide adequate water rights for NPS purposes. (390.000)	
Establish NPS water rights. (390.101 - 390.899)	
Conduct studies to support NPS water rights claims as part of the Little Colorado River adjudication (#2)	390.101
Interpret water rights and issues. (390.900 - 390.999)	

Manage Paleontological Resources For Their Preservation

Fossils found within Grand Canyon encompass much of the spectrum of types and preservation, including algal mats and bacterial spores over a billion years old, mummified dung and hair about 11,000 years old, and a multitude of body and trace fossils from the Paleozoic Era, 550-250 million years old.

PROGRAM OBJECTIVES

NPS policy recognizes the irreplaceable nature of these fossils and outlines strategies for their preservation and study. Adequate management strategies outlined in *NPS 77* (page 2.155) include:

1. Identification of fossil resources present in parks through literature and collection surveys, consideration of strata present in the park, and on-the-ground paleontologic surveys. Thousands of prehistoric species have been identified in Grand Canyon, and a comprehensive, annotated bibliography has been prepared by Dr. Earle Spamer.
2. The significance of fossil resources found in the park must be evaluated. Fossils may have value for interpretation, exhibits, historical studies, or science. Evaluation requires close coordination with the scientific community, whether through a Park paleontologist or outside experts. At present, the scientific expertise needed for these determinations is not available at Grand Canyon N.P.
3. With fossil resources located, and their significance determined, they must be managed for their preservation. Depending on the particular fossil

resource, management strategies include: 1) no action, 2) monitoring, 3) cyclic prospecting, 4) stabilization and reburial, 5) shelter construction, 6) excavation, 7) area closure, and 8) regular patrols (*NPS 77* p. 2.163). All six strategies have been used in Grand Canyon, but without benefit of an overall plan.

Although a tremendous amount of scientific data has been recovered from the paleontologic resources of the Grand Canyon, little is known about this resource from a managerial standpoint.

PROPOSED PROGRAM EMPHASIS

To devise a comprehensive management plan for the park's fossil resources, six areas of work are necessary: 1) documenting fossil resources, 2) drafting a management plan, 3) monitoring sensitive resources, 4) mitigating natural and human damage to fossil resources, 5) fostering paleontologic research in the Park, and 6) interpreting the Park's fossil resources.

Based on the diversity of paleontological resources present in Grand Canyon N.P., a preliminary assessment of staffing needs (RMAP Allocations Nov. 1993) indicates a need for 3.5 FTE's to fully manage and implement the program (currently no FTE's are devoted to it).

Initial establishment of a Park geoscientist position could be used to begin management of fossil, cave and geologic resources. After initial work is fully outlined, the staff can be augmented. It is likely a portion of the 3.5 FTE's would be "filled" through research

work, either contracted or invited. Currently, there are no FTE's devoted towards paleontological resources management.

GOAL #1: Documenting Fossil Resources (N20) in and from the Park is the first step in devising a management strategy. The necessary information is available from a number of sources, and may be explored concurrently on several fronts. Information developed should be entered into a geo-referenced database used to guide management actions. Potential information sources are:

- A. **Physical specimens** in the Park's collections provide an excellent starting point for documenting the range of fossil material present. Holding in other institutions undoubtedly include types and localities not represented in the park's collections.
- B. **Scientific literature** helps document specimens in the collections, and provides information on localities where no collections were made or whose specimens can not be located. The annotated bibliography compiled by Dr. Spamer probably will fulfill this need with only minor updating.
- C. **Creation of a paleontological locality database** will help draw information on fossil resources in the Park into one, management-accessible location. The database package will be geo-referenced, and allow addition of monitoring data. As additional localities are discovered, they will be added to the database. The database package design will carry information from the documentation phase of a paleontological monitoring program into the rest of the program.

GOAL #2: Monitoring of Sensitive Paleontological Resources (N23) is vital to preserve these resources. For the monitoring program to respond to Park needs, fossil resources must be categorized by their vulnerability to theft, erosion, or other forms of degradation. The value of the fossils (for interpretive, scientific, or other uses) must also be known. This information can then be used to devise a monitoring program ensuring the fossils retain their value and triggering necessary mitigation actions.

GOAL #3: An Overall Management Plan (N23) guides paleontological resource management, defining and coordinating paleontological monitoring, mitigation, research, and discoveries. It contains management guidelines necessary to evaluate the significance of individual fossils and localities, devise appropriate monitoring programs, and identify research topics. It also helps to determine mitigation actions needed to preserve the resource. Research topics, especially those with important management implications, should be prioritized within the plan. The Park has fossil resources and needs information, but it is usually outside researchers who have the expertise and access to funding. By a clear statement of Park needs, the resource, needs, expertise and funding can be brought together more readily. The paleontological program in the Park will change with new discoveries and changing impacts, so the management plan should be an evolving document.

GOAL #4: Mitigating threats to paleontological resources is necessary if the fossils are to be preserved (N23). Mitigation is usually thought of as removing a threat from a resource, and this course of action is appropriate in many cases. Since fossils are generally quite fragile and yet subject to natural forces of destruction, mitigation

actions also include removal of the fossil itself. Proper collection will insure the scientific value of a specimen is preserved.

GOAL #5: Fossil Resource

Interpretation is underway in the Park. The Resource Management and Interpretation divisions should work together, insuring issues in paleontological resource management are included in interpretive programs. Open communication between the divisions will allow the public to learn about life of the past, and how the fossil resources that provide this information are studied, understood, and preserved.

GOAL #6: Fostering Paleontological Research (N23) in Grand Canyon is the best way to learn about this resource. With the exception of the older Proterozoic strata and Quaternary lavas, strata in the Park are

fossil-bearing. A search of the 1,215,735 acres in the Park for all fossil outcrops is clearly outside the ability of Park staff. However, by fostering research, and ensuring the results of that research include useful management data (locality information, resource sensitivity and threats, etc.), the effectiveness of the program will be greatly enhanced. Fostering research includes proposal review and permit processing, but also assistance in funding or providing field facilities and logistic support. Providing such support should be driven by priorities established in a fossil resource management plan, but some flexibility will be necessary to meet the realities of the research community.

PROJECT STATEMENT REFERENCES

Program / Project Identification	Project statement numbers
Manage paleontologic resources for their preservation.	400.000
Document paleontological localities throughout the Park.	410.000
Develop and maintain paleontological locality database	410.101
Inventory & Photodocument paleontological resources	410.102
Provide an overall management plan for preserving fossil resources.	430.000
Prepare a paleontological resources management plan	430.001
Develop paleontological research program guidance	430.101
Monitor sensitive paleontological resources.	440.000
Mitigate damage to paleontological resources.	450.000
Preserve threatened paleontological resources	450.101
Foster paleontological research	470.000
Interpret paleontology and Park fossil resources.	490.000

Manage Cave Resources For Their Preservation

Hidden within the Grand Canyon are an estimated 300 caves. Most are dissolved into the limestones of the Redwall and Muav formations, although others are known. The existence of these caves is well known to the caving community, and the Cave of the Domes, on Horseshoe Mesa, is frequently visited. Caves throughout the park contain unique cave formations or "speleothems," mummified remains of extinct Ice Age fauna, archeological remains (including split-twig figurines), and unique biological systems. Many caves also play a major role in regional hydrology, as evidenced by substantial streams emerging from Vasey's Paradise, Cheyava Falls, and Roaring, Thunder, and Tapeats springs. In spite of their importance, management of caves and their resources in Grand Canyon has been haphazard. An outdated Cave Management Plan exists, and a permitting system has been devised, but both need updating and publicity. The full extent of caves and cave resources has not been systematically documented, nor is there an ongoing program monitoring these resources and mitigating impacts to them.

In addition to the laws pertaining to other park resources, caves and their resources are protected under the Federal Cave Resources Protection Act of 1988. Based on these references, *NPS 77* provides specific program guidance for cave management (p. 2:135). A cave management program is based on fundamental knowledge of the extent of cave resources (including water chemistry, speleothem condition, cultural and biological resource status, etc.) present in the park, a situation not present at Grand Canyon. Although it is estimated there are 300 caves in the Park, a detailed survey has not been conducted, and files are maintained on only

83 caves. Based on the estimated extent of cave resources in the Park, RMAP generated a need for 2.26 full-time equivalents (FTE's) to manage these resources ("RMAP Allocations", Nov. 1993). Current management is done on an ad-hoc basis with no FTE's assigned.

PROPOSED PROGRAM EMPHASIS

An adequate cave management program for Grand Canyon N.P. must consist of six major fields of effort. These areas are discussed sequentially, but in practice they will form a feedback net. New data developed in one area will affect the work in another, with overall structure provided by an evolving management plan.

GOAL #1: Documentation of Cave Resources (N21) is necessary before any action can be taken. Documentation assesses information currently in Park files, information from cavers, and in-the-ground survey of caves themselves. Consultation with Native American groups will be necessary to determine if a particular cave is a Traditional Cultural Property. Current files contain information on 83 Park caves, although individual file contents range from only a cave identification number to complete surveyed maps, photo transects, resource evaluations, and monitoring protocols. All available cave resource information must be consolidated into a database package that is: 1) useful to management, 2) geo-referenced for integration into other Park resource themes, 3) capable of protecting the confidentiality of location and resource data, and 5) containing information about cave geology, hydrology, ecology, cultural significance, and physical and biological hazards. Cave maps may be

integrated into the database or maintained separately. Documentation will begin with data already available in Park files and expand to knowledge held by others. Full documentation of the resource will require a major exploration effort to discover, map and inventory caves (discussed under "Research").

GOAL #2: Monitoring Cave

Resources (N21) documents either preservation or degradation. Sufficient information is currently available to resume monitoring of some caves (e.g. Cave of the Domes). Based on documented cave resources, and guidance contained in law, policy, and a Park Cave Resource Management Plan, monitoring protocols should be established for all caves, and monitoring should be carried out. A monitoring program includes human recreation and research use levels in the cave, radon monitoring, condition of known cave resources and identification of new resources. Results from the monitoring program are used to adjust use levels or implement mitigation strategies needed to preserve cave values.

GOAL #3: A Cave Management

Plan (N21) drives the overall management process, adapted to the cave resources present in Grand Canyon. It should define the permitting process for visiting park caves. Park-specific criteria used in applying cave classifications (see *NPS 77* p. 2.147) should be identified. Although impact monitoring programs will be cave-specific, the management plan should provide overall monitoring guidance. The plan should also guide mitigation of human impacts on cave resources. The last Cave Management Plan for Grand Canyon was approved in 1980. A draft revision was prepared in 1985, but never completed. Both efforts precede passage of

the Federal Cave Resource Protection Act. A new cave management plan is needed for Grand Canyon, including current law and policy, as well as information gained since 1985. The old Cave Management Plan contained some search and rescue information. While this information properly belongs in the Park's search and rescue plan (*NPS 77*, p. 2.140), some coordination between the two plans will be necessary.

GOAL #4: Mitigation of Human

Impacts (N21) will ensure preservation of existing, and restore cave values. Mitigation measures include interpretation of cave etiquette, non-disclosure of cave locations and features, and limiting access to caves. Mitigation may also include seasonal cave closures based on the life cycles of cave inhabitants. In some cases mitigation may restore damaged cave resources. Mitigation can also include recovery of specimens collected from Park caves. While it will be impossible to restore such specimens to their caves, having the specimens in Park collections will make at least some of their information value available to researchers and the public.

GOAL #5: Interpretation of Park

Caves and Cave Resources (N21) is necessary to protect caves within the park while still making the information they contain available to the public. Interpretive messages should be designed to meet the Park's needs for specific audiences. For example, backcountry users need to understand the need for, and process for obtaining a cave permit before visiting caves. Readily accessible caves (Cave of the Domes) may need on-site interpretation of cave etiquette. While interpretation should not promote cave use, it should promote cave

preservation, and present the results of cave research in a non-cave specific manner.

GOAL #6: Fostering Cave Research

(N21) is an ideal strategy for meeting both Park and caver needs. Individual research projects may focus on specific topics, including cave or karst geology, hydrology, threatened and endangered species, or paleontology. By supporting research projects in Grand Canyon caves, private groups will be able to develop data not available to Park management. Data may include cave locations, resources, threats, or conditions. The NPS and the National

Speleological Society have signed a memorandum of understanding that will improve opportunities for cave research and exploration. In entering partnerships, Park data needs and accuracy requirements must be set forth clearly to derive maximum benefit from exploration and inventory work. Results can then be used to evaluate current management protocols and mitigation strategies, either through comparison with virgin caves or through assessment of inventoried impacts.

PROJECT STATEMENT REFERENCE

Manage Cave Resources for their preservation	500.000
Document caves and cave resources in the Park. (510.000)	
Document cave resources in Grand Canyon N.P.	510.001
Provide overall management strategies for cave resources. (530.000)	
Cave management planning.(530.100 - 530.999)	
Update Cave Management Plan	530.101
Monitor caves and their associated resources. (540.000)	
Establish a cave monitoring program and protocols. (540.100 - 540.999)	
Mitigate damage to cave resources caused by human factors. (550.000)	
Foster research into Park caves and their resources. (570.000)	
Map and inventory caves in Grand Canyon N.P.	570.101
Interpret Park caves and cave resources. (590.000)	

Manage Park Geologic Features and Processes For Their Perpetuation

Grand Canyon is world-renowned as a geological showcase. Geologic studies in the park began with the work of Newberry in 1858 and continue today. The Grand Canyon's excellent display of stratified rock is invaluable in unravelling the geologic history of the region, while the extensive dissection of the plateaus allows detailed study of tectonic movements. Processes of stream erosion and vulcanism are easily seen and studied. This section of the Plan discusses management actions needed to understand and protect geologic features of the Grand Canyon, perpetuate natural geologic processes, and provide for visitor health and safety. Paleontology and cave resources, while of a geologic nature, are addressed in a separate legal framework and thus are discussed in separate sections of the Plan.

All too often, geology is thought of as timeless processes operating so slowly as to be imperceptible in a human time scale. Unfortunately, this misconception often leads to neglecting geologic resources, both in terms of understanding and management. In reality, major changes can occur in relatively brief periods of time. These quick changes may be triggered by human actions, such as changes in the Colorado River's ability to erode and transport sediment caused by the closure of Hoover and Glen Canyon dams.

Rapid changes may also result from natural processes such as the debris flows creating Crystal Rapid and destroying sections of the trans-canyon water line overnight in 1966. Understanding these processes must occur before the desirability of, and strategies for mitigation and management can be developed.

PROPOSED PROGRAM

EMPHASIS (N06, N10, N20, N21, N23, N24)

Although all geologic resources are interrelated, the field has been subdivided for the purposes of this plan into six areas: 1) soils, 2) geologic features, 3) geologic processes, 4) geologic hazards, 5) fossil resources, and 6) cave resources. As noted above, the last two are discussed elsewhere in the plan. The RMAP does not contain full-time equivalent (FTE) projections applicable to the former 4 phases of geologic resource management. However, it is evident that at least 2 FTE's would be required simply to coordinate the various programs. Many additional FTE's (NPS, contract, and outside researcher) are necessary to implement various actions called for. Currently, there are no FTE's assigned to manage geologic resources, and any such activities are done on an ad-hoc basis.

GEOLOGIC RESOURCES MANAGEMENT	R-MAP FTE ALLOCATION
Cave Management	0.00
Developed Caves	0.00
Undeveloped Caves	2.26
Mining & Minerals Management	
Mining Claims	0.00
Nonfederal Oil & Gas Operations	0.00
Nonfederal Mineral Operations Other Than Oil/Gas	0.00
Geothermal Resources Management	0.23
Volcanic Resources Management	0.00
Shoreline Management	0.00
TOTAL FTE'S	2.49

GOAL #1: *Managing Geologic Hazards to Protect Human Health, Safety and Property*

As in any natural environment, geologic features and processes in Grand Canyon pose threats to the health and safety of visitors and to property. Some of the hazards are not under human control (e.g. earthquakes), while others are the direct result of past human activity (e.g. abandoned mines). In addition, abandoned mines threaten other park resources (e.g. mine drainage). An effective

program to protect people and property from these threats consists of 5 basic steps:

- 1) hazard identification and documentation,
- 2) monitoring of threat levels, 3) mitigation of threats and hazards, 4) research to identify previously unknown threats, and
- 5) interpretation to inform the public of threats and safety measures.

A. Hazard identification and documentation is an ongoing process. Some hazards, such as open mine shafts, have already been identified and documented. Other threats are known,

but not documented (e.g. mine drainage into Lava Creek). Natural geologic processes of weathering and erosion constantly produce new rockfall hazards. A comprehensive program of hazard identification needs to be developed for the Park. Attention should focus on those hazards that pose a real threat to people or resources. For example, loose rock on the Canyon walls is a hazard, but may not be a threat in a remote area, while it may constitute an imminent danger above a heavily used trail. Documentation of threats should include nature and location of the hazard, resources threatened, and immediacy of threat. The inventory should be designed to not only allow, but encourage identification of new hazards.

B. A monitoring program should be used to monitor the condition of hazards and the immediacy of threats. Monitoring programs can be used to monitor unstable slopes to provide advance warning of landslides. The program can also be used to monitor the effectiveness of mitigation measures.

C. Mitigation of threats can take a variety of forms, based on the nature of the hazard and the immediacy of the threat. No action may be desirable in remote areas where hazards are natural phenomena and threats are low. For example, a potential rockfall in a wilderness may require no corrective action. In a more developed area, drainage diversion to slow undermining, or even triggering the rockfall through explosives may be the desired mitigation. Other resource values may define mitigation measures. For example, mine shaft closure techniques may vary depending on cultural resource values, and use by threatened or endangered wildlife. Some hazards, such as seismic risks, can not be controlled, and mitigation takes the form of preparedness.

D. Research to identify and mitigate geologic hazards and threats can strengthen the Park management program. The information may develop incidental to other geological research in the Park, or it may be the focus of a specific research effort. In some cases the hazard may be great enough, and the threat imminent enough, that contracting of research may be desirable. In other cases, data collection "added on" to other projects may provide information in a timely manner.

E. Interpretation is vital to communicate hazards to the visiting public. It is not possible, nor even desirable, to eliminate all potential geologic hazards and threats from the Park. However, visitors and Park staff should be aware of methods to avoid danger, and be prepared for unexpected dangers. Such interpretation can be site/hazard specific (e.g. warning of cave-ins at abandoned mine shafts), or of a more general nature (e.g. the danger of rockfalls in the Canyon). The overall goal of such interpretation would be to promote safety in a hazardous environment.

GOAL #2: *Perpetuation of Natural Geologic Processes*

In examining the geology of the Grand Canyon, there is more to the resource than the rocks of the Canyon. The geologic processes that have carved the Canyon from those rocks also represent a resource to be managed. "Management of geologic processes" may seem an oxymoron. Many geologic processes, such as earthquakes or flash floods, are clearly beyond human control. While a geological process may not be amenable to control, the effects may be mitigated, and the process itself can certainly be monitored. Many other geologic processes are influenced by human actions. Geologic

processes can be broadly divided into four categories: 1) tectonic processes (earthquakes and earth movement), 2) weathering (*in situ* decomposition of rock), 3) erosion (removal of weathered material), and 4) sediment transport (a subdivision of erosion, but here used to discuss the movement of sediment and debris in the Colorado River and its tributaries).

A management program for geologic processes in Grand Canyon N.P. is aimed at perpetuating these processes, at their natural rates. Although the specific nature of the processes is described below, the management program for all consists of four basic steps: 1) identification of the process, 2) monitoring the rate of change produced by the process, 3) determining human impacts on process initiation and rates, and 4) implementation of appropriate mitigation measures. Fostering research into these processes, and interpreting them to the public, have the same values as those identified under "Geologic Features" (above).

A. Tectonic processes are not controlled by human factors, although minor earthquakes have been triggered by human actions (e.g. filling of Lakes Mead and Powell). However, monitoring of the process is often possible. Detailed geologic mapping reveals faults, which help to define areas of seismic potential. Detailed studies in areas prone to seismic activity can include mapping, instrumentation and trenching to reveal changes in elevation, stress fields, and other geophysical changes preceding or following seismic activity. This information is valuable to science. They may also be of value in mitigating damage to human health and safety (see the "Geologic Hazards" section below).

B. Weathering is generally caused by natural factors. However, some human factors, such as atmospheric acidic deposition ("acid rain"),

heavy human use, and chemically contaminated runoff from developed areas may alter weathering rates. All geologic features in the Park are affected to some extent by weathering, but monitoring of weathering effects should be confined to features of special interest. Control of acidic deposition is a regional program (see the Air Quality section of the Plan). Increased weathering due to heavy human use may be mitigated by surface treatments, diverting use to areas better able to withstand impact, or outright closure. Contaminated runoff should be captured and treated to mitigate its impacts.

C. Erosion rates are definitely affected by human activity. Changes in vegetative cover, soil development, and runoff diversions can all increase erosion rates far above natural rates. Increased erosion impacts the area being eroded through soil removal, lowering local water tables, and damage to cultural resources. Downstream erosion impacts include decreased water quality, reduced channel capacity, burial of biologic and cultural resources, and biological changes. Mitigation measures may include no action where natural pedogenic processes can repair the damage, better water collection and diversion engineering in developed areas, better control of use to avoid soil compaction, installation of berms and other erosion control structures, and area closures. Selecting a mitigation measure depends on the severity of the problem, management goals for the area, and the potential to restore a natural regime.

D. Sediment transport is a natural consequence of weathering and erosion. From a management perspective, two aspects of sediment transport are of concern. The first is episodic debris flows in the side canyons of the Grand Canyon. These debris flows are composed of sediment ranging in

size from microscopic clay particles to boulders many feet in diameter. Although water serves as a debris flow lubricant, the majority of the material in transit is solid. Overall, the flows have the consistency of wet concrete. They reconfigure stream bottoms through which they pass, and create rapids if they reach the Colorado River (such as the flow that created Crystal Rapid in its present form in 1966). There is the potential for such debris flows to create "unrunnable" rapids in the River. Studies of debris flows in the Grand Canyon have established chronologies for various tributaries which may be of value in predicting flow potential for the tributaries, and to plan desired mitigation actions for threatened resources (including cultural resources and recreational values at risk).

The second type of sediment transport of managerial concern occurs in the Colorado River. Sediment, particularly sand, transported by the River is placed in temporary storage on the river bed, along beaches and in terraces (particles finer than sand tend to pass through with little storage, while larger gravels and cobbles are transported only during major flood flows). Depending on the location of storage, the sand forms riparian habitat, beaches for recreation, and river bars and eddies important for fish. Extensive studies of sand transport dynamics have been accomplished as part of the Glen Canyon Environmental Studies, since transport is largely governed by water release rates from Glen Canyon Dam. Although the studies have amassed volumes of information about sediment transport, continued monitoring is needed to assess continuing impacts of dam operations, and flood impacts from tributaries below the dam. Based on monitoring data, further modifications to the operation of Glen Canyon Dam may be needed to mitigate

adverse impacts.

GOAL #3: *Geologic Feature Management*

Modern geologic investigation of the Grand Canyon began with the visit of Newberry to the western Canyon in 1858. Since that time geologists have defined rock layers in the Canyon, grouped, subdivided and redefined them, until today over 95 different names have been applied to the (current) 28 major formations in the Canyon walls. Thousands of references regarding the geology of the Grand Canyon are contained in Spamer's *Bibliography of the Grand Canyon and the Lower Colorado River* (1990). The Grand Canyon is one of the most intensively studied geologic areas in the world, but management of geologic resources by the NPS in recent years has been limited to studies on the effects of Glen Canyon Dam and to reviewing and issuing permits for other research. While it is true that some geologic resources tend to be rather inert, changing only slowly through time, this perspective is not appropriate for the management of individual geologic features. Some are quite fragile, and subject to rapid deterioration or destruction. The identification, monitoring and preservation of these features should be an important function of resource stewardship at Grand Canyon N.P. To that end, a geologic feature management program must consist of the following programs:

A. Identification and documentation should be pursued for geologic features within the Park. On a broad scale, this project has been accomplished with the geologic mapping of the entire park at a 1:62500 scale. However, the maps are not yet completely digitized and available in computerized form. There is no comprehensive listing of smaller-scale geologic features of special interest. Examples of such

features would include caves and paleontological resources discussed elsewhere in the Plan, and erosional, depositional, structural and mineralogical specimens, features of ethnographic importance to groups traditionally associated with the Canyon (Traditional Cultural Properties), sources for prehistoric raw materials, type sections of various strata, and measured sections (including well logs from the area). Identification, geo-referenced documentation, and analysis of threats to these resources must precede preservation of them.

B. Monitoring of geologic features should concentrate on those features of greater scientific/cultural value and vulnerability. Monitoring the features documents rates of change in the condition of the feature and the level of threats facing continued preservation of the feature. The monitoring program will indicate the need to initiate mitigation measures.

C. Mitigation of threats to geologic features will be based on the nature of the threat, the value of the feature, and overall management goals for an area. In cases of human-caused threats, the decision to take action will be more easily defined than in those cases where natural processes threaten a natural feature. Potential mitigation measures cover a broad spectrum of actions. For example, no action may be desirable if only natural processes threaten a feature of only moderate importance. Human threats may be mitigated through interpretation (on site or orientation), or through area closure. Collecting the feature and placing it into Park collections may be desirable for smaller features of value. Installing monuments at type sections or important measured sections may guard against their "loss", but may not be appropriate in a wilderness area. Mitigating threats to geologic features must be accomplished on a case-by-case basis.

D. Promoting research into geologic features will be necessary for effective management. Geologic features are in a constant state of flux, from their formation, through change, and toward ultimate destruction. It is unreasonable to expect NPS staff to be fully aware of all changes occurring to all features throughout the Park. However, by fostering geologic research in the Park, outside expertise can identify features of interest, threats faced by those features, and propose mitigative measures. Such information may be the purpose of research, or be incidental to other research programs. The results of geologic research in the Park are also important to interpretation, communicating these findings to the public. The NPS can support research through direct contracting (for those studies of immediate management or interpretive concern), or indirectly through logistical support (provision of field laboratory facilities, supplementary funding from NPS or cooperating association). A clear statement of Park research needs may also help researchers in obtaining outside funding.

E. Interpretation of geologic features is a major theme at Grand Canyon. While inadequate facilities, funding and staffing levels prevent a full presentation of this theme, these limitations are addressed in other Park management documents. However, interpretation of geologic features should involve an open dialogue between interpretation and resource management, so that new findings, information needs, and management concerns can be exchanged. Inclusion of interpretive questions and concerns in research proposals and permits will assist interpreters presenting new findings and understanding to the public. Clear statements of management concerns can be communicated through interpreters to the public as well.

GOAL #4: *Soil Resources*

Management

Soils within Grand Canyon N.P. are highly variable, ranging from moist forest soils of the North Rim to shallow, dry mineral soils and bedrock exposures of the Inner Canyon. Human impacts on Park soils include large areas with essentially no impacts, areas formerly used for farming, grazing and mineral extraction, and the heavily impacted soils of developed areas. Management goals for Park soils are broadly stated as:

1) maintaining natural soil-forming processes, 2) controlling erosion triggered by human influences, 3) avoiding contamination of soils by non-native chemical, physical or biologic agents, and 4) making soil-suitability information available for planning. To meet these needs, soil resource management for Grand Canyon should consist of the following, interrelated areas:

A. Documentation of soils in the Park has been begun, with soils maps for the Havasupai Traditional Use Area and the Sanup Plateau. A digital soil map for the entire park should be prepared. To work toward this goal, attention should first focus on those areas where impacts to soils are likely, the developed areas of the rims and cross-Canyon corridor. Then, using the data from existing soil surveys, a preliminary soils map for the park could be prepared by combining vegetation and geologic themes in the Park's geographic information system. Such a product would provide a "first approximation" for further study and verification.

B. Monitoring of soil impacts (soil erosion, compaction and contamination) will reveal natural processes that should be perpetuated,

and human-caused impacts that should be mitigated. Monitoring intensity will be governed by the extent of impacts, ranging from occasional "check-ups" of remote areas to frequent analysis of developed areas.

C. Mitigation of human impacts can proceed after the impacts have been identified and characterized. Pedogenesis (soil formation) is an ongoing natural process. In remote areas, natural pedogenesis may be sufficient to restore soils. In developed areas, active measures may be needed, based on specific impacts (contamination, compaction, accelerated erosion). Mitigation should include avoiding impact to soils. Avoidance measures include proper siting of developments, walkways, and drainages, analysis of any soil material transported into the park for contaminants (physical, biological or chemical), and proper waste disposal. Mitigation efforts will involve coordination among the Resource Management, Professional Services, and Maintenance division staffs.

D. Soils research will improve soil resource protection in the Park. The wide range of soil types and the relatively undeveloped nature of the Park can serve as a "baseline" for other, more developed areas. Research into soil dynamics in the Park will provide Park management and the scientific community with a better understanding of the resource. Specific research problems may also be identified by the Park, including improved mitigation techniques, and micro-analysis in areas of special concern (cultural resource sites, the River corridor, etc.).

E. Interpretation of soils resources offers a challenge to inform the public about the importance, and vulnerability of soils. Many cultural processes, from agriculture to recreation, are ultimately dependent on soils.

Greater public awareness of these resources
will enhance their protection.

PROJECT STATEMENT REFERENCE

- Manage Park geologic features and processes for their perpetuation. (600.000)**
 - Manage Park soils to ensure their preservation and functioning. (610.000)
 - Document Park soil types and occurrences. (610.100 - 610.199)
 - Direct overall management of Park soils. (610.200 - 610.299)
 - Monitor human-caused impacts on Park soils. (610.300 - 610.399)
 - Mitigate human-caused impacts on Park soil resources. (610.400 - 610.599)
 - Foster research into Park soils and soil processes. (610.600 - 610.799)
 - Interpret Park soils and their preservation (610.900 - 610.999)
 - Manage bedrock geologic resources for their preservation. (620.000)
 - Document Park bedrock geology and geologic features. (620.100 - 620.199)
 - Provide managerial guidance for bedrock geologic features. (620.200 - 620.299)
 - Monitor impacts and condition of geologic features. (620.300 - 620.399)
 - Mitigation human-caused impacts to geologic features. (620.400 - 620.599)
 - Foster research into geologic features. (620.600 - 620.799)
 - Interpret Park geologic features and processes. (620.900 - 620.999)
 - Manage geological processes occurring in the Park to ensure their continuance. (630.000)
 - Characterize and monitor tectonic movement. (630.100 - 630.199)
 - Characterize and monitor weathering processes, and mitigate human impacts. (630.200 - 630.299)
 - Characterize and monitor erosional processes, and mitigate human impacts. (630.300 - 630.399)
 - Characterize and monitor sediment transport processes, and mitigate human impacts. (630.400 - 630.599)
 - Debris flows. (630.600 - 630.799)
 - Colorado River sediment transport and storage. (630.900 - 630.999)
 - Manage geologic hazards to protect human health and safety. (640.000)
 - Document geologic hazards present in the Park. (640.100 - 640.199)
 - Evaluate geologic hazards and protect life and property 640.101**
 - Monitor levels of geologic threats. (640.200 - 640.399)
 - Mitigate threats to Park resources and the public from geologic hazards. (640.400 - 640.599)
 - Manage and reclaim abandoned mineral lands 640.401**
 - Foster research to identify and mitigate geologic hazards. (640.600 - 640.799)
 - Interpret geologic hazards to foster visitor and employee health and safety. (640.900 - 640.999)

Manage Air Quality To Preserve and Restore Natural Conditions

Grand Canyon N.P. enjoys some of the cleanest air left in the United States. This clean air is a fragile resource, and existing levels of human-caused pollution create clearly visible hazes. Numerous studies have been conducted to characterize this haze, its composition and origin. In addition to visibility studies, monitoring programs in the park measure acid deposition (both wet and dry), ozone concentrations, and meteorological data. Special studies have augmented this information with other data in support of special studies.

Grand Canyon N.P. is a federal Class I area under provisions of the Clean Air Act as amended. This status does not reflect the cleanliness of existing air quality. Rather, it affords protection from increases in ambient concentrations of various "criteria pollutants" (ozone, lead, nitrogen oxides, sulfur dioxide, carbon monoxide, and particulates less than 10 micrometers in diameter). While national standards for concentrations of criteria pollutants have been set to guard human health and safety, damage to other resources may occur at pollutant levels below the standards. The Clean Air Act also set a goal for no human caused visibility impairment in Class I areas (such as Grand Canyon N.P.) through the prevention of future hazes and the elimination of existing hazes. In support of this goal, the EPA has required a 90% reduction in sulfur emissions from the Navajo Generating Station (Page, AZ) because of the impact of those emissions on visibility in the Grand Canyon.

The value of air quality studies extend beyond management of park resources. Most

air quality monitoring in the United States focuses on "problem areas", urban centers, manufacturing complexes and the like. Monitoring in rural areas like Grand Canyon develops a natural baseline for determining the characteristics of relatively pristine air, and for assessing the pervasiveness of pollutants.

PROPOSED PROGRAM EMPHASIS (N14)

To protect air quality and its related resources in Grand Canyon N.P., an extensive program of data collection and interpretation is needed. Under and overall management plan, 1) existing air quality conditions must be established, 2) pollution sources affecting the Park must be identified, 3) impacts of air pollution on Park resources should be established, 4) identified pollution impacts should be mitigated, and 5) air quality, its values and preservation should be communicated to the public. Projections by the RMAP program identify almost 4 full-time equivalent staff (FTE's) for air quality management, including 1.24 FTE for planning, interpretation, regulatory work and biological effects monitoring, 2.03 FTE for instrument maintenance and monitoring, and 0.56 FTE for meteorological monitoring. The sections below outline specific steps to manage air quality in Grand Canyon N.P. Currently, there is 1 FTE assigned to monitor air quality at Grand Canyon.

AIR QUALITY MANAGEMENT	R-MAP FTE ALLOCATIONS
Biological Effects, Planning, Regulatory and Interpretive Activities	1.24
Instrument Monitoring	2.03
Meteorological Monitoring	0.56
Aircraft Overflight Management	1.24
TOTAL FTE'S	5.08

GOAL #1: Documentation of Existing Air Quality Conditions is an ongoing job. Because of the natural variability of air quality conditions, a long baseline of information is needed to make meaningful interpretations of "average conditions" and "trends." Improved monitoring techniques and new pollutants of concern may augment or replace existing monitoring procedures. Our ability to define or measure air quality impacts on Park resources improve through time as well. Thus, to document existing air quality, three types of data collection and interpretation are needed.

A. Monitoring of ambient air quality documents what is in the air. A variety of instruments measure light transmission and scattering, sample aerosols, measure gas concentrations, and record meteorological conditions. These measurements need to be carried out over long time periods to provide a reliable data baseline. Short-term studies may be carried out to identify particular pollutants or to assess impacts for particular pollution sources. Data from special studies

should be integrated into the long term databases. At present, nearly all ambient air quality monitoring is funded and/or contracted through the WASO Air Quality Division, which employs the technical expertise needed to produce scientifically defensible data and interpretations, and contracts for data analysis and technical support to field sites. This system has worked well. However, the park must be prepared to assume at least partial funding of the program if necessary, to preserve a scientifically valuable baseline.

B. Establishing potential effects of air pollution on park biota is the first step in monitoring resource damage caused by air pollution. The effects of various pollutants in a range of concentrations on a number of plant and animal species has been documented in the literature. The biota of Grand Canyon N.P. should be referenced against pollution effects studies to identify species at risk and symptoms to monitor. Based on the information developed in this comparison, a monitoring program can be instituted to watch for resource degradation.

C. *Identification of air quality related values* in Grand Canyon N.P. has been attempted at various times in the past. Visibility and biotic health have been identified. However, many assessments are dated (e.g. "integral vistas") and some have never been studied (e.g. impacts on geologic features). A systematic analysis of park resources and experiences, and the impact of air pollution on them should be developed. The listing should be updated regularly, and used to set monitoring and mitigation priorities.

GOAL #2: Documentation of Impacts on Park Resources is needed to produce mitigative options for dealing with air pollution. Although the mere presence of air pollutants may have legal significance, it is the impacts of those pollutants that drive legislative and administrative action to ensure clean air. By the same logic, documentation of impacts on Park resources adds immediacy to the need for mitigation, as well as documenting the changing conditions of Park resources. Three major resource impact categories can be identified:

A. *Visibility impacts* of air pollution are well documented. Numerous studies have correlated the presence of air pollutants and reduction in visibility. The socio-economic impacts have also been studied, although results are less conclusive. Continued monitoring of visibility will document the physical changes occurring. Aesthetic components of visibility require continuing studies to determine the socio-economic impacts of current and future visibility conditions. Because Park visibility is so sensitive to small increases in pollutants, it can also serve as an early warning to watch for other resource impacts.

B. *Impacts of acid deposition* have not been studied in the Park, although precipitation chemistry has been measured since 1981. Current precipitation acidity is near normal, so base-line investigations of soils, biota, and cultural features should be made. With such a baseline in place, current or future resource degradation can be identified.

C. *Documentation of air pollution effects on growth, reproduction and health of park biota* ("bioeffects") must be made if ecosystem health is to be preserved. Current monitoring is limited to ozone effects on *Pinus ponderosa*, but other pollutant-sensitive species are known from the Park, including *Rhus trilobata* and several species of lichens. Comprehensive monitoring of the full range of Park environments should be established. Although ensuring the health of park biota is the primary goal of such a program, a secondary benefit is the identification of pollution problems in remote areas of the Park where no monitoring efforts are currently underway.

GOAL #3: Overall Program

Guidance is provided by a park Air Quality Management Plan. The Plan will ensure that all facets of the air quality management program at Grand Canyon are carried out in a coordinated and integrated fashion. Monitoring of various air quality characteristics has been carried on in the park since 1959, producing a considerable body of information on which to build. The air quality management plan integrates and directs research and management efforts, but it must remain a dynamic document. Since air quality in the Park is dependent on actions hundreds of miles away, such flexibility is essential so the Plan can respond to the changing physical, chemical and legal environment.

GOAL #4: *Identifying the Sources of Air Pollution* affecting park resources is needed if impacts are to be mitigated. In some instances, establishing a cause-effect relationship can be relatively straightforward, particularly for local sources. However, pollution is carried into the Park from many distant sources as well. Identifying these sources is much more difficult. Thus, a two-tiered approach to source identification is needed:

A. Identification and quantification of local sources defines those air pollution sources close to, or within the Park. Only one large pollution source lies within 100 km. of the Park (the Navajo Generating Station), but numerous smaller sources lie within this radius. Because of their proximity, these sources may have a disproportionate impact on air quality and its related resources. An inventory of pollution sources is needed to ensure they do not adversely impact air-quality related values in the park or violate environmental compliance regulations. This inventory will also demonstrate NPS commitment to clean air goals.

B. Identification and quantification of regional pollution sources defines those sources contributing to the regional haze that frequently limits visibility in the Park, and other pollutants carried into the Park (such as ozone precursors). These pollutants may have adverse impacts on park resources other than visibility as well. Because of their distance, emissions from individual facilities tend to disperse and blend. Therefore sources tend to be defined in terms of regions (e.g. Los Angeles Basin, Las Vegas metropolitan area), although individual contributions from isolated large sources (e.g. Mohave Power Project) may have significant, measurable impacts.

GOAL #5: *Mitigation of Air Pollution Effects on Park Resources* focuses primarily on reducing pollution levels. Although some sensitive objects could be collected and preserved in the Park collections, this is not a viable option for most park resources, nor is it compatible with overall preservation goals. The NPS has no direct control over the issuance of air pollution permits, but does have the responsibility under the Clean Air Act to work with state, tribal and federal air pollution control agencies to insure the permits they issue do not damage park resources. Mitigation of impacts can proceed on two fronts, within the Park and external to the Park.

A. Controlling in-Park emissions will mitigate air pollution impacts from sources over which the Park does have direct control. Such sources may include management fires for vegetation management, concession operations (tour buses, boilers, etc.), visitor and domestic emissions (campfires, wood stoves), and park operations (vehicle fleets, surface coatings, construction projects, etc.). In those areas where the Park does have direct control, mitigation will not only reduce threats to Park resources, but also set a good example for overall pollution management. Indeed, it may be possible to obtain special funding for such demonstration projects.

B. Control of external emissions will require close cooperation between the Park (either directly or through the WASO Air Quality Division) with the state, tribal or federal agencies actually issuing permits. Such cooperation and dialogue can be on a reactive, issue by issue basis. In better, pro-active programs, the Park participates in regional planning efforts. One such effort, the Grand Canyon Visibility Transport Commission, has

been formed to deal with visibility issues affecting the entire Colorado Plateau. This and similar multi-state, multi-agency efforts can be used to promote coordinated strategies to address regional air quality issues that do not respect legal boundaries.

GOAL #6: *Interpretation of Air*

Quality Issues is an ongoing program at Grand Canyon. The program has been successful in informing the public about the pollution problems faced by the Park and its resources. The effort must continue and evolve as impacts to Park resources change. A strong interpretive program also allows the

public an opportunity to understand or at least appreciate the complexities of air pollution, its sources, impacts, and remedies. Individual human actions multiplied by millions of people have caused pollution problems. Educating people to reduce their impacts, multiplied by millions of park visitors, reduces pollution problems.

PROJECT STATEMENT REFERENCES

Manage Air Quality in Grand Canyon to preserve and restore natural conditions	700.000
Provide overall planning for protection of air resources. (710.000)	
#2 Develop a park air quality management plan (#2)	710.001
Characterize existing air quality conditions. (720.000)	
Monitor air ambient quality. (720.100 - 720.299)	
Identify potential effects of air pollution on Park biota. (720.300 - 720.599)	
Identify Air Quality Related Values. (720.600 - 720.799)	
#3 Identify air quality related values present in Grand Canyon N.P. (#3)	720.601
Identify air pollution sources impacting park resources. (730.000)	
Identify and quantify local (< 100 km.) air pollution sources. (730.100 - 730.399)	
#1 Inventory of in-park air pollution sources and environmental compliance (#1)	730.101
Identify and quantify regional (> 100 km.) air pollution sources. (730.400 - 730.699)	
Document impacts of air pollution on Park resources. (750.000)	
Document physical impacts on visibility. (750.100 - 750.299)	
Document chemical impacts of acid deposition. (750.300 - 750.499)	
Document impacts of air pollution on growth, reproduction and health of park biota. (750.500 - 750.699)	
#4 Establish and monitor biological effects of air pollutants (#4)	750.501
Mitigate air pollution impacts on Park resources. (770.000)	
Reduce harmful emissions in the park. (770.100 - 770.199)	
Participate in regional air quality regulatory and advisory organizations. (770.400 - 770.599)	
Participate in regional air quality management efforts	770.401
Interpret park air quality and air pollution effects. (790.000)	

Outdoor Recreation Management

INTRODUCTION

The Grand Canyon National Park backcountry consists of over one million acres of primitive lands and proposed wilderness, approximately 240 free-flowing miles of the Colorado River, and the developed inner canyon "Corridor" areas including Indian Gardens, Phantom Ranch, and Cottonwood. Over 23,000 visitors float the river annually. Approximately 12,000 people hike the proposed wilderness each year, and approximately 25,000 camp in the developed Corridor campground. Total annual use is approximately 233,000 user nights.

Visitor experience throughout the recommended wilderness is not always consistent with wilderness. Visitors are negatively impacted by crowding at camping areas and congestion at attraction sites. Non-conforming uses, such as motorized boats and other vehicles within the proposed wilderness also negatively impact visitors.

Resource impacts continue to occur at numerous campsites and visitor attraction sites. Campsite expansion and the development of social trailing are the primary impacts.

The proposed wilderness contains 30 hiking trails of approximately 375 miles. 18 of these "backcountry" trails (approximately 260 miles) contain historic features (i.e. retaining walls, tread riprap, log cribbing etc.). Most of these trails have receive little or no stabilization or rehabilitation work since establishment of the Park over 75 years ago.

Aircraft Overflights

Grand Canyon National Park, by far, exceeds

all other parks in air tour flights over its lands. The air tour industry is comprised of 42 companies from five states. This multi-million dollar industry carries approximately 750,000 passengers averaging 80,000 flights per year. In the summer months, flights are estimated at 10,000 per month. Projections are that flights will double in number by the year 2010.

CURRENT PROGRAM

With the abundance of recreational activities and the enormous influx of visitors into the backcountry, only 1 FTE is assigned to manage this program. Two one-month long river trips are launched every year, where a collection of approximately 10 to 16 volunteers help restore disturbed wilderness areas. Much is accomplished on these trips, but the program cannot keep-up with the damage caused by visitors. The following table illustrates the numbers of staff required to achieve a fully-funded program. Currently, only 16% of the staff necessary is at hand.

The current Aircraft Overflight Management Program has only approximately 0.5 FTE to handle this extremely complex and volatile issue. The RMAP process has identified the need for 1.24 FTE to adequately maintain this program

DISTURBED AREA REHABILITATION	R-MAP FTE ALLOCATION
Abandoned Road Restoration, Rehabilitation, &/or Revegetation	2.26
Rehabilitation of Backcountry Campsites, Trails, &/or River Corridors Commonly Used by Boaters	3.39
Rehabilitation of Other Disturbed Areas (e.g. campgrounds, picnic areas, ORV-impacted areas and abandoned landfills, mines and borrow pits)	0.56
TOTAL FTE'S	6.22

PROPOSED PROGRAM EMPHASIS (N18, N19, N20, N22)

GOAL #1: Integrate NPS Wilderness Preservation and Management Guidelines into Backcountry and River Management Plans. Establish Levels of Acceptable Change (LAC) consistent with wilderness for resource impacts and visitor experience.

GOAL #2: Pursue Wilderness and Wild and Scenic River designation for suitable areas.

GOAL #3: Provide for diverse recreational opportunities consistent with Park purposes. Coordinate with adjacent and other land management agencies to provide information on regional recreational opportunities.

Strategies

1. Conduct necessary research to establish LAC standards.

- Backcountry Research and Monitoring (GRCA-N-800.001).

- Colorado River Visitor Use Impact Monitoring (GRCA-N-800.002).
- Study and Mitigate Stock Impacts (GRCA-N-810.004).

2. Monitor against LAC standards recreational impacts on backcountry/ wilderness resources and visitor experience.

- Backcountry Research and Monitoring (GRCA-N-800.001).
- Colorado River Visitor Use Impact Monitoring (GRCA-N-800.002).
- Develop Travel Simulation Model for Colorado River (GRCA-N-800.003).
- Research and Monitor Natural Quiet (GRCA-N-800.005)

3. Develop appropriate Management Plans for Resource and Visitor Impacts Identification and Issue Resolution.

- Revise Backcountry

Management Plan (GRCA-N-820.001).
- Revise River Management Plan (GRCA-N-820.002).

4. Mitigate resource impacts exceeding LAC standards.

- Stabilization and Rehabilitation of Historic Trails (GRCA-N-810.001).
- Rehabilitation of Wilderness Resource Impacts (GRCA-N-810.002).
- Develop Wilderness Waste Management Program (GRCA-N-810.003).
- Study and Mitigate Stock Impacts (GRCA-N-810.004).

- Mitigate Road Impacts to the Basin Meadow (GRCA-N-810.005).
- Manage Aircraft Overflights (GRCA-N-810.006)

5. Pursue Wilderness and Wild and Scenic River designations.

- Update NEPA Compliance for Wilderness Designation (GRCA-N-830.001)
- Conduct Wild and Scenic Rivers Suitability Study (GRCA-N-830.002).

Natural Resources Data Management Program

INTRODUCTION

The park has a fully functioning GIS system and program. The plan identifies development of basic data themes such as geology, and soils. The plan recognizes and makes provisions for expansion and utilization of databases and information gathered from surrounding agencies. It also provides for development of enhanced communications and cooperative information exchanges through networking with those agencies and with off-site research centers and universities.

CURRENT PROGRAM

R-MAP FTE allocation tables show that approximately 4.5 FTE's are required to achieve the goals and objectives set forth in this program. At present, only .5 FTE is assigned to this program. Johnny, is this true? I'll need a little help here from you, unless you have a reference I could use which would give me the same info. Thanks.

-JOHN!!! ONCE AGAIN, PLEASE PRIORITIZE THESE PROGRAM AREAS SO THAT I CAN PRIORITIZE YOUR PROJECT STATEMENTS. THANKS!!!!

PROPOSED DATA MANAGEMENT PROGRAM EMPHASIS (N20, N24)

Goals:

- a. Develop and maintain a Geographical Information System capable of meeting the multidivisional needs of the park for organizing, analyzing, and presenting large interrelational databases in a spatially referenced format for easy

comprehension and use by park management.

- b. Develop interagency and university networking and data sharing capabilities.
- c. Develop and implement an integrated data management plan for Grand Canyon.

Strategies for Data Management: NR-900.000

GRCA-N-900.101 Develop and Expand GIS Program

GRCA-N-900.102 Develop Geographical Information Networking/Data sharing capabilities.

GRCA-N-900.103 Develop Wildlife-Habitat Relationship Database for Grand Canyon National Park

GRCA-N-900.104 Develop an integrated GRCA Resources Management Division data management plan.

GRCA-N-900.105 Implementation of integrated data management Plan

GRCA-N-900.106 Establish an independent scientific review panel for GRCA RMD protocols, and projects.

GRCA-N-900.107 Develop and update biological taxon checklists.

CULTURAL RESOURCES MANAGEMENT PROGRAM

The cultural resources management program also follows a simple and logical process:

KNOW
RESOURCES
I.D. &
EVALUATE

HISTORIC RESOURCE STUDIES
& ARCHEOLOGICAL SURVEYS, ETC.

DETERMINE NATIONAL REGISTER ELIGIBILITY

MANAGE CULTURAL RESOURCES ACCORDING TO MANAGEMENT
OBJECTIVES

PLANNING & COMPLIANCE

> INTEGRATE INTO PLANNING
> AVOID/MINIMIZE ADVERSE EFFECTS
> JUSTIFY MOST APPROPRIATE USE
&/OR ULTIMATE TREATMENT

TREATMENT

> EXCAVATION
> REHABILITATION
> RESTORATION
> RECONSTRUCTION

MAINTAIN, PROTECT AND INTERPRET
RESOURCES, INCLUDING DATA

Cultural Resources Management and Research Administration

INTRODUCTION

This function is devoted to the overall management of the basic programming requirements, maintenance or on-going program and project needs, and oversight of research activities of cultural resources management. Base professional staff needs are key components necessary for administration of legal requirements of cultural resource management.

Staff professionals to accomplish the numerous responsibilities associated with the management and administration of the cultural resources program are focused on day-to-day administration rather than program development. Professional standards, as dictated by the Secretary of the Interior's Standards for Archeology and Historic Preservation, are met at this time only by the Park Archeologist, Park Curator and Park Compliance Officer, but not for other program areas of historic preservation.

These positions are divided among the divisions of Resources Management and Professional Services. Currently, there is no "branch of cultural resources management". Although staff members may work together in a cooperative manner, there is no unifying direction for all cultural resources management programs. The division of Park Maintenance is also involved in the management of cultural resources because of the many historic structures and landscapes which are currently occupied by staff.

The lack of professional staff positions, such as a Historic Architect, Historic Landscape Architect, Historian, and Ethnographer,

hampers any kind of program development. Additionally, outside research cannot be directed or administered in any consistent fashion to meet park purposes and values given the lack of professional staff to create and direct programs. Current staff can address historic preservation compliance, curation and archaeological issues, but lack professional status for any of the other required cultural resource programs.

Effective management of cultural resources in Northern Arizona and Colorado Plateau areas require interaction with adjacent land managers, universities and Indian Tribes. Working and interactive relationships must be maintained, with various neighboring land managers, regional and state academic institutions.

Similarly, effective government-to-government relationship with eight separate Indian Tribes. Continuance of this relationship requires professional staff and commitment. Maintenance of the relationship with the tribes is currently done by the Park Archeologist as a component of the larger Archaeological Management Program. While the liaison is positive and active, the program is primarily active on an as-needed basis at this time. The maintaining of relations with the tribes is required by several laws and NPS Management Policies. Maintenance of the relationship with the Havasupai is specifically required by the 1975 Enlargement Act.

Management

The Cultural Resources Management and Research Administration program will

coordinate the various aspects of related cultural resources management for full integration. Addition of professional staff to be responsive to park management needs is key to the success of the program.

Development of interagency and inter-tribal agreements will foster working relationships outside our traditional boundaries and onto the plateau areas where they are most useful.

The activity of cultural resources management is mandated by law and policy. Major historic reservation laws include the Historic Sites Act of 1935, the National Historic Preservation Act of 1966 (as amended), and the National Environmental Policy Act of 1969. Of particular importance to archeological resource management are additional documents such as specific NPS laws and regulations, NPS Management Policies, the Antiquities Act (1906), the Archaeological Resources Protection Act of 1979 (as amended 1988), the Native American Graves Protection and Repatriation Act of 1990. Additional for curation are the Museum Properties Management Act of 1955, 43 CFR Part 79 "Curation of Federally Owned and Administered Archeological Collection, and 36 CFR Section 2.5 "Research Specimens".

Application of these laws, regulations and policy for the management of the cultural resources of Grand Canyon is based upon the guidelines established in NPS-28. These guidelines outline 3 principal areas:

1. Research, to identify, evaluate, and establish other basic information about cultural resources;
2. Planning, to ensure that this information is well integrated into management processes for making decisions and setting priorities; and

3. Stewardship, under which planning decisions are carried out and resources are preserved, protected, and interpreted to the public.

CURRENT PROGRAM

The Cultural Resources Management Program at Grand Canyon National Park is divided amongst three independent branches coordinated through the divisions of Resource Management and Professional Services which focuses on the following areas: Archaeology, Ethnography, Museum Collections, Cultural Landscapes, Historic Structures, and Historic Resource Studies. These areas are not necessarily limited to the Park boundaries, although with the limited staff, Colorado Plateau-wide studies are nearly impossible.

The current Cultural Resources Management effort is fragmented within the park and unevenly managed because of a lack of professional staff and unified direction. Archeology and Native American liaison are supervised by an archeologist who has one permanent archeologist on staff, the museum collection is supervised by a curator with two curators as permanent staff; both are in the Resources Management Division. Historic resource studies, historic preservation, and Section 106 Compliance of NHPA are coordinated by an archeologist within the Professional Services Division who has no staff. Actual maintenance of historic buildings and structures are achieved through the Maintenance Division under the Buildings and Utility Foreman for day labor and under a temporary Architect Technician for contracted preservation projects. Some cultural landscape inventory and analysis was accomplished by the park landscape architect between 1990 and 1993, however, this was on an as-needed basis.

Research is conducted at the Northern Arizona University Satellite Office, Division

of Resources Management Cultural Branch. This Flagstaff office coordinates and administers the long-term monitoring and remedial actions for cultural resources in the river corridor as part of the compliance required by Section 106 of the National Historic Preservation Act related to the Operations of Glen Canyon Dam. Aside from monitoring physical archeology and geomorphological areas, the river corridor project addresses Native American concerns by providing field experience to tribal representatives during scheduled monitoring trips. There are 2 term employees stationed at this office, and 2 university employees dedicated to the project.

With this plan a Cultural Resources Management Branch is being proposed within the Resources Management Division. For this reorganization to be successful, full professional staffing is necessary. Focus of the Branch will be on Archeology, Ethnography, Museum Collections, Cultural Landscapes, Historic Structures and Historic Resource Studies.

The Past Five Years

Cultural Resources Management is split between the divisions of Maintenance, Professional Services and Resources Management. For the past five years, the following projects have been a focus for management activities and emphasis between one or more of these divisions:

Glen Canyon Dam Environmental Studies:

On July 27, 1989, the Secretary of the Interior directed the Bureau of Reclamation (BOR) to prepare an EIS on the Glen Canyon Dam operations. Since then, the branch has spent a great deal of time and emphasis on this issue, representing the NPS in all meetings, reviews, studies, and Native American concerns. The staff archeologist

has been the lead for all compliance related activities for sections 106 and 110 of NHPA, initiated and coordinated all tribal consultations, developed interdisciplinary research with USGS, preparation of mitigation measures with tribal partners, and coordinated and prepared the Cultural Resources sections and analyses for the Environmental Impact Statement on the Operations of Glen Canyon Dam.

Adjacent Lands and Boundary Issues:

Numerous pieces of legislation exist establishing the boundary locations for Grand Canyon National Park and the Hualapai and Navajo Indian reservations. The legal descriptions are in conflict and resolution of the location has not been reached, although Department of the Interior Solicitor's opinions have been issued for each. Appropriate uses which promote the preservation of Grand Canyon's resource values within these boundary disputed areas are in conflict. Also, the park archeologist has been involved in various interagency and private adjacent land activities such as grazing and subsistence.

Recreational Impacts: The park archeologist has been involved in providing compliance and direction to the trail and campsite restoration projects around archeological sites. Many river trips, both private and commercial, take people to various archeological sites, sometimes damaging and degrading the resource. An inherent conflict exists in backcountry areas given that preferred camping locations today were also preferred 100 years ago and 1000 years ago. Most modern day campsites are located in or near archaeological sites, and all hiking trails except the South Kaibab and River trails follow prehistoric routes.

Curatorial: There are more than 220,000

artifacts related to the Grand Canyon including the following types: archeological, fine arts, historical, archival, ethnological, as well as biological, geological, and paleontological. There are 17,000 photographic images alone in the collections. The curatorial storage facility has been a primary concern for this program area. Current storage is not a fire-proof, secure or environmentally controlled facility, threatening the very existence of these collections. The construction of this new facility has begun, and is being implemented in a piecemeal fashion, as funding is made available every year. Computerization of the collection is progressing with approximately half of the collection entered into ANCS.

Historic Structures:

Cultural Landscapes: One Cultural Landscape Report was developed for the historic housing area on the south rim, as a response to the urgent lead abatement program. Some research and analysis has been developed for the south rim Grand Canyon Village in response to the current GMP. A Cultural Landscape Inventory was conducted for Phantom Ranch in response to some vegetation management issues there.

Compliance: Compliance documents related to Section 106 of NHPA have been prepared under the Servicewide Programmatic Memorandum of Agreement between the NPS and the State Historic Preservation Officers for "No Effect" projects for 145 separate projects. GRCA has completed more clearance reports than any other park in the Western Region, outnumbering both YOSE (total 98 reports) and GOGA (88 reports) over the last 5 years. In addition to the "No

Effect" reports, a Programmatic Agreement has been developed by the branch in coordination with the Bureau of Reclamation, State Historic Preservation Officer, Advisory Council on Historic Preservation, and 8 separate Indian tribes for the operations of Glen Canyon Dam.

Compliance funds were secured for the first time in FY94 from FIREPRO to augment ONPS dollars used for the surveys and documentation required as part of the prescribed burn program.

Consultation: In the past 5 years, we have had a resurgence in the Indian consultation/liaison program in response to the Glen Canyon Dam EIS, Park GMP, NAGPRA, and the amendments to NHPA. Active consultation and communication is maintained with 8 separate Indian tribes, represented by 7 separate entities. Tribal representatives have been involved in the Interpretive Prospectus, GMP planning issues, and a variety of issues related to resource management and preservation related to Glen Canyon Dam. NAGPRA agreements are currently being developed with Hopi, Zuni and Hualapai.

TYPE OF NPS EMPLOYEE		FTE's OF RESOURCE WORK		
		Natural	Cultural	Total
RESEARCH SCIENTISTS (I.e. Research Grade Evaluation and Research Grant Administration Programs)		0.0	0.0	0.0
RESOURCE SPECIALISTS (e.g. 170, 190, 193, 401, 404, 430, 808, 1015, 1016, 1060, 1215, etc.)		8.6	7	15.6
025 PARK RANGERS- Resources Management		0.0	0.0	0.0
025 PARK RANGERS- Resources Protection		0.0	0.0	0.0
025 PARK RANGERS- Resources Interpretation		0.5	0.5	1.0
MAINTENANCE PERSONNEL		0.8	0.0	0.8
TOTAL OF ALL RESOURCES PERSONNEL		9.9	7.5	17.4
TOTAL PARK FTE (ALL PERSONNEL)	PERCENTAGE OF PARK FTE DEVOTED TO RESOURCES....			
317		3.1%	2.4%	5.5%

RESOURCE PROTECTION

Resource protection for cultural resources is accomplished by interaction with the Protection Division through ad-hoc patrols and site monitoring. Both rim and inner canyon districts in the park have allowed personnel to conduct "ARPA" related patrols to monitor site condition in coordination with the Archaeologists. Western Regional funds have been allotted in the amount of \$5000 per year for the last few years to augment ONPS funds. Remote cameras have been installed at certain sites to monitor activity, and fixed-wing overflights of the Kanab Plateau have been conducted in the

past to aid in ground patrols.

INTERPRETATION

Participation in training of interpretive staff, preparation of interpretive brochures, lectures, and participation in Arizona Archaeology Month are all components of an on-going education and interpretation program.

PROGRAM OBJECTIVES

According to NPS Management Policies, "*The NPS will conduct a coordinated program of basic and applied research to support planning for and management of park cultural resources*"

(NPS-28, 1993:21).

The primary objective of GRCA's cultural resource management and research administration program is to meet the basic requirements as outlined in NPS-28 to ensure that cultural resources in GRCA are identified, and properly managed and preserved. This is done through a systematic program of *research, planning, and stewardship*.

Research

Within the research program, the overall management and research administration program should provide the direction for the research and management of the various components of cultural resources. This includes establishment of professional positions to design and implement the necessary research to meet our basic inventory requirements.

Planning

Effective cultural resource management and research administration serves to (1) integrate cultural resource concerns into other park planning and management processes; (2) provide professional staff for appropriate design and integration of information so as to minimize adverse effects on resources; and (3) identify the most appropriate research and methodology for implementation. Planning should ensure that all compliance is carried out, and all consultation is taken into account in decision-making.

Stewardship

The NPS Management Policies requires that *"pending planning decisions, all cultural resources will be protected and preserved in their existing conditions."* In reaching decisions about resource treatment, preservation should always receive first consideration. Excavation, rehabilitation, restoration, and reconstruction may serve

legitimate management purposes, but these treatments cannot add to and will likely subtract from the finite material and data sources remaining from the past (NPS-28).

ISSUES

Critical issues which relate to this program center on the lack of baseline inventory data on cultural resources throughout the park, lack of research and interpretation of the resources, and the lack of professional staff for appropriate preservation programs.

For most types of resources in the park, no inventory is available to provide park managers the necessary information concerning basic resource condition. Without the basic information, status of the resource which affects management decisions cannot be determined. Ongoing degradation and loss of cultural resource values continues due to a lack of staff professionals to evaluate conditions and provide preservation treatments.

Compliance with federal laws and NPS Management Policies as they relate to cultural resources is not being met due to a lack of staff.

Visitor safety related to the intentional or unintentional use of cultural resources is critical for the basic preservation of the resource and the maintenance of the visitor experience.

PROPOSED PROGRAM EMPHASIS

The following pages present a more detailed description of proposed cultural resource and research programs for Grand Canyon. They outline a logical thought process for a suitable program for each area. At the end of each section will be a list of project statements necessary to achieve these program goals and

objectives. ****(Next version of RMP will have some figures from CRMAP, it will take a little while to figure out some rough numbers but GRCA will get something for "FTE's for a fully funded program".)

Each program section can be lifted out of the looseleaf form of this Resource Management Plan, along with its list of project statements. This may prove useful for funding officials who require further justification for individual project statements. This may also be suitable for use by other park employees who wish to be better acquainted with each program area. The most important reason

for this format is as an overall guide for each program manager and staff to use for daily, weekly, monthly and yearly activities within the branch. Short-term and long-term goals can thus be woven into daily activities.

Please note that each program are may be structured differently. Each area, in fact, is inherently different in its nature, its needs and its approach. As a result, they will be managed accordingly. The uniqueness of each program area is only strengthened by the continuity of the vision and goals described at the beginning of this chapter.

TOP TEN PRIORITES FOR CULTURAL RESOURCES MANAGEMENT, 1994

- | | | |
|-----|----------------|--|
| 1. | GRCA-C-110.000 | Increase Cultural Resources Management Staff |
| 2. | GRCA-I-230.022 | Construct Museum Storage Facility |
| 3. | GRCA-C-400.002 | Implement Systemwide Archeological Inventory Program |
| 4. | GRCA-C-340.008 | Develop Building Preservation Guides with Inventory Condition Assessment Program |
| 5. | GRCA-C-330.000 | Complete Cultural Landscape Studies |
| 6. | GRCA-C-130.001 | Liaison with Indian Tribes |
| 7. | GRCA-C-700.001 | Prepare Ethnographic Overview and Assessment |
| 8. | GRCA-C-320.000 | Complete Historic Resource Studies |
| 9. | GRCA-I-200.002 | Provide Base Funding for Museum Collection |
| 10. | GRCA-I-200.001 | Provide Curatorial Cyclic Funding |

****This list has been changed and re-changed recently. This may not adequately represent the final top 10 priorities.

CULTURAL RESOURCES MANAGEMENT: OUTLINE

GRCA-C-100.000	CULTURAL RESOURCES MANAGEMENT AND RESEARCH ADMINISTRATION
GRCA-C-110.000	INCREASE CULTURAL RESOURCE MANAGEMENT STAFF
GRCA-C-110.001	Establish Park Ethnographer
GRCA-C-110.002	Establish Park Historian
GRCA-C-110.003	Establish Park Historic Architect
GRCA-C-110.004	Establish Indian Liaison
GRCA-C-110.005	Establish Resource Liaison
GRCA-C-110.006	Establish Park Historical Landscape Architect
GRCA-C-120.000	ESTABLISH INTERAGENCY, UNIVERSITY AND TRIBAL COOPERATIVE AGREEMENTS
GRCA-C-120.001	Establish Liaison Position with local Universities
GRCA-C-120.002	Establish MOU's with Adjacent Tribes for Co-Management of Natural Resources
GRCA-C-130.000	MAINTAIN GOVERNMENT TO GOVERNMENT RELATIONSHIPS WITH INDIAN TRIBES
GRCA-C-130.001	Liaison with Indian Tribes
GRCA-C-130.002	Conduct Research into the Legal and Administrative History of Reservation and GRCA Boundaries
GRCA-C-200.000	MUSEUM COLLECTION MANAGEMENT PROGRAM
GRCA-C-200.001	Provide Curatorial Cyclic Maintenance
GRCA-C-200.002	Provide Base Funding for Museum Collection
GRCA-C-200.003	Collection Management Plan
GRCA-C-200.004	Insure Compliance with Special Directive 80-1 (revised)
GRCA-C-210.000	MAINTAIN THE MUSEUM COLLECTION
GRCA-C-210.020	Inventory of Museum Collection
GRCA-C-210.021	Microfiche Museum Collection Materials
GRCA-C-210.023	Develop Photographic Documentation of the Museum Collection
GRCA-C-210.024	Computerization of the Museum Collection
GRCA-C-210.028	Catalog Backlog of Museum Specimens
GRCA-C-220.000	MAINTAIN ORAL HISTORY PROGRAM
GRCA-C-220.018	Protect Oral History Collection
GRCA-C-220.020	Collect Oral History Interviews with CCC workers
GRCA-C-220.030	Develop Oral History Program
GRCA-C-230.000	IMPROVE MUSEUM COLLECTION STORAGE
GRCA-C-230.016	Develop Fire Protection and Security for Museum Collections

GRCA-C-230.017	Complete Historic Boats Storage Facility
GRCA-C-230.022	Construct New Museum Storage facility.
GRCA-C-240.000	MAINTAIN HISTORIC PHOTOGRAPH COLLECTION
GRCA-C-240.019	Maintain Photograph Collection
GRCA-C-240.020	Obtain Copies of Photographs in Other Collections.
GRCA-C-300.000	HISTORIC RESOURCES MANAGEMENT PROGRAM
GRCA-C-300.009	Data Management for Historic Resources
GRCA-C-300.011	Concession Consultation on Historic Resources Management
GRCA-C-310.000	ADMINISTRATIVE HISTORIES PROGRAM
GRCA-C-310.014	Prepare Administrative History of GCNP
GRCA-C-310.020	Prepare Administrative History of Natural Resource Management and Research
GRCA-C-320.000	COMPLETE HISTORIC RESOURCES STUDIES
GRCA-C-320.001	Prepare HRS on ATSFRR and its Predecessors in GCNP
GRCA-C-320.002	Prepare HRS of NPS Development at GRCA, 1919-1966
GRCA-C-320.003	Prepare HRS on Rim Roads, Trails and Backcountry Historic Resources.
GRCA-C-320.004	Prepare HRS on Trails Below the Rims in the Canyon.
GRCA-C-320.005	Prepare HRS of UPRR/Utah Parks Co. Development on North Rim
GRCA-C-320.006	Prepare HRS of Mining in GCNP
GRCA-C-330.000	CULTURAL LANDSCAPE MANAGEMENT PROGRAM
GRCA-C-331.000	Identify and Nominate Cultural Landscapes to NRHP
GRCA-C-332.000	Inventory Cultural Landscapes
GRCA-C-333.000	Implement Cultural Landscape Information Management Program (CLI)
GRCA-C-334.000	DEVELOP CLR(S) FOR ALL PARK CULTURAL LANDSCAPES
GRCA-C-334.001	Develop CLR for Grand Canyon Village
GRCA-C-334.002	Develop CLR for East Rim Drive and Overlooks
GRCA-C-334.003	Develop CLR for West Rim Drive and Overlooks
GRCA-C-334.004	Develop CLR for Hermit's Rest Area
GRCA-C-334.005	Develop CLR for Watchtower Area at Desert View
GRCA-C-334.006	Develop CLR for North Rim Inn Area
GRCA-C-334.007	Develop CLR for North Rim Headquarters Area
GRCA-C-334.008	Develop CLR for Grand Canyon Lodge Historic District
GRCA-C-334.009	Develop CLR for Tuweep Ranger Station Area
GRCA-C-334.010	Develop CLR for Bright Angel Trail
GRCA-C-334.011	Develop CLR for South Kaibab Trail

GRCA-C-334.012	Develop CLR for Corridor River Trail
GRCA-C-334.013	Develop CLR for North Kaibab Trail
GRCA-C-334.014	Develop CLR for Phantom Ranch Area
GRCA-C-334.015	Develop CLR for Cottonwood Campground Area
GRCA-C-334.016	Develop CLR for Rim Trail
GRCA-C-334.017	Develop CLR for Tusayan Museum Area
GRCA-C-334.018	Develop CLR for Yavapai Point Museum Area
GRCA-C-340.000	PRESERVE HISTORIC STRUCTURES
GRCA-C-340.001	Establish In-Park Preservation Crew
GRCA-C-340.002	Complete Kolb Studio Historic Furnishing Plan
GRCA-C-340.003	Development of Historic Properties
GRCA-C-340.004	Rehab Powell Memorial
GRCA-C-340.005	Complete HABS or HAER Recordings
GRCA-C-340.006	Fire Protection for Historic Structures
GRCA-C-340.007	Update List of Classified Structures
GRCA-C-400.000	ARCHEOLOGICAL RESOURCES MANAGEMENT PROGRAM
GRCA-C-400.001	Develop Parkwide Research Design for Archaeological Resources
GRCA-C-400.002	Implement the Systemwide Archaeological Inventory Program (SAIP)
GRCA-C-410.000	IMPLEMENT COMPREHENSIVE PROGRAM FOR MONITORING ARCHEOLOGICAL SITES (VISITOR AND NATURAL IMPACTS)
GRCA-C-410.001	Conduct Monitoring of Archaeological Sites within Developed Areas of the Park
GRCA-C-410.002	Conduct Monitoring of Archaeological Sites Along Backcountry Trails
GRCA-C-410.003	Conduct Monitoring of Archaeological Sites Along the Colorado River
GRCA-C-420.000	DEVELOP MITIGATION PLANS FOR IMPACTS TO ARCHEOLOGICAL SITES
GRCA-C-420.001	Develop Archaeological Data Recovery Program
GRCA-C-420.002	Cyclic Maintenance of Masonry Ruins
GRCA-C-420.003	Develop Site Stabilization Plans (non-masonry)
GRCA-C-430.000	FIRE EFFECTS AND ARCHAEOLOGY
GRCA-C-430.001	Assessment of Effects of Management Fires on Archaeological Remains
GRCA-C-430.002	Post-Burn Damage Assessment for Fire Rehabilitation Program
GRCA-C-440.000	MAINTENANCE OF ARCHAEOLOGICAL DATABASE
GRCA-C-440.001	Convert Existing Site Files Into ASMIS

GRCA-C-440.002	Maintain and Update Existing Site Specific Site Files
GRCA-C-440.003	Maintain and Update Base Topographic Maps of Archaeological Site Locations
GRCA-C-440.004	Convert Existing Base Maps Into GIS files
GRCA-C-440.005	Maintain and Convert Photographic Files Into Computer Database
GRCA-C-440.006	Maintain and Convert Artifact Analysis Information Onto Computer Database

GRCA-C-500.000 CULTURAL RESOURCES INFORMATION MANAGEMENT PROGRAM

GRCA-C-510.010	Enter Cultural Data into GIS Database
GRCA-C-500.015	Management of Park Library
GRCA-C-500.020	Obtain Copies of All GCNHA Bibliography Material.
GRCA-C-500.025	Obtain Copies of Grand Canyon Material in Other Repositories.
GRCA-C-500.030	Information Integration with Other Services
GRCA-C-500.035	CRBIB
GRCA-C-500.040	National Technical Center and National Technical Information System
GRCA-C-500.045	Design and Replace the South Rim Visitor Center's Exhibits.
GRCA-C-500.050	Survey and Inventory Collections for Grand Canyon Natural and Cultural Objects

GRCA-C-600.000 CULTURAL RESOURCES COMPLIANCE

GRCA-C-610.000	Ensure Compliance with NHPA
GRCA-C-610.001	Conduct Archaeological Surveys for Section 106 Compliance
GRCA-C-610.002	Complete National Register Nominations for Archaeological Sites
GRCA-C-610.003	Implement Programmatic Agreement for the Operations of Glen Canyon Dam

GRCA-C-620.000 ENSURE COMPLIANCE WITH ARPA

GRCA-C-620.001	Establish Law Enforcement Patrols
GRCA-C-620.002	Insure Confidentiality of Site Location Information

GRCA-C-630.000 ENSURE COMPLIANCE WITH NAGPRA

GRCA-C-630.001	Establish MOU/PA with Indian Tribes For Items in GRCA Collection
GRCA-C-630.002	Establish MOU/PA with Indian Tribes for Inadvertent Discoveries

GRCA-C-640.000 ESTABLISH COMPLIANCE PROCEDURES WITH NEPA

GRCA-C-640.001	Establish SOP for NEPA Review
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GRCA-C-700.000 ETHNOGRAPHIC RESOURCES MANAGEMENT PROGRAM

GRCA-C-700.001	Prepare Ethnographic Overview and Assessment
GRCA-C-700.002	Prepare Cultural Affiliation Study
GRCA-C-700.003	Develop and Implement Consultation Plan
GRCA-C-700.004	Develop and Implement a Native American Resource Collection and Use Plan
GRCA-C-710.000	INVENTORY AND MONITORING ETHNOGRAPHIC RESOURCES
GRCA-C-710.001	Identification and Management of Traditional Cultural Properties
GRCA-C-710.002	Design and Implement the Ethnographic Resource Inventory Database
GRCA-C-710.003	Develop Mitigation Plans for Impacts to Traditional Cultural Properties

Museum Collection Management

INTRODUCTION

The goals of a professional museum collection include preservation, study and communication. The Grand Canyon Museum Collection has the specific goal of collecting and preserving objects which document the canyon's unique cultural and natural history as well as protecting objects which would be destroyed on-site. Providing controlled access to the collection allows utilization of the data stored within the objects to benefit many. Researchers include local, national and international press and publishers; authors; students; park staff and curious visitors to the canyon. The information provided to visitors and park staff increases in quality through utilization of original objects in exhibits and utilization of the object information for creation of interpretation programs. A small interpreters collection composed of objects from the canyon, including illegally collected objects lacking provenience, is also maintained for use on interpretive walks.

Grand Canyon National Park staff have been preserving natural and cultural history items since the park was created in 1919. The collection has grown to include a wide variety of objects. The Natural history collections include mammal, bird, insect, alcohol, geology, paleontology, tree ring, and herbarium collections. The history collection includes archives, historic photographs, fine arts, rare books, components of historic structures as well as information and materials documenting the history of mining, tourism, railroad, early pioneers, river boating, concessions, resource management projects and many more subjects. The collection also includes an ethnology collection as well as a large archeology collection.

PROGRAM OBJECTIVES

The purpose of the museum collection is to gather and protect objects and specimens which are representative of the cultural and natural history resources of Grand Canyon National Park. The collection seeks to protect the objects by using archival storage techniques in controlled, secured storage areas to slow deterioration for as long as possible so that the objects and the information they contain remain available to researchers and park management for decades, and even centuries. Special projects are continually being completed to better protect objects, such as microfiching information to provide a non-destructive means of accessing collection information. The second half of the museum's work is to provide controlled access to the material so that it is available and useful to park managers and researchers. This includes proper cataloguing with information arranged to assist and simplify research data searches.

ISSUES AND SYSTEMWIDE ISSUE CATEGORIES

Problems with the collection deal with storage (C09, C15, C16), information (C03), and staffing needs (C24). There is insufficient staff to properly catalog, provide access to and care for the collection. Substandard storage areas do not allow proper protection of museum objects and do not meet NPS or professional museum standards. Incomplete cataloging and computer entry work do not allow thorough information searches to be completed. Data is not utilized because it is inaccessible since it has not been catalogued. Lack of knowledge of other sources of information, research work, etc., does not provide for efficient use of limited research work efforts. For example, without a

thorough knowledge and copies of previous research work, efforts may be duplicated by current researchers due to lack of knowledge of that preexisting work. The depth of the information available through the museum and library collections could be greatly increased by gathering information on sources of Grand Canyon material outside the park as well as through such means as collecting oral histories. Making more data available to researchers and park management will help increase the quality of projects being completed as well as to provide better understanding of past events which, in turn, may help to develop better solutions for future needs.

CURRENT PROGRAM

ONPS and cyclic finds are used to provide the staffing necessary for basic care and preservation of the collection including housekeeping, environmental and pest monitoring projects, accessioning and cataloging projects, providing access to the collections, and providing basic accountability for the collection including completing yearly inventories. Funding must be moved to ONPS sources rather than cyclic to provide the stability necessary to maintain and operate museum programs. The Curator supervises the day-to-day activities of the museum collection as well as completes all long-range planning documents and budget requests. The museum technicians assist researchers, complete preservation and storage projects, accession and catalog incoming objects, and enter artifact information on the computer for more efficient data management. The museum photographer maintains the historic photograph file by completing darkroom projects necessary to maintain loan photograph files, coping historic photographs loaned to the park to increase the subjects available to users, and making copy negatives of deteriorating

original negatives. Depending on funding, additional staff are hired to complete a variety of projects related to the museum collection such as cataloguing archive collections, entering catalog worksheets on the computer, and completing oral history transcription work, etc.

GS-1015 Curator, 1 FTE
GS-1016 Museum Technician, 2 FTE
GS-1060 Photographer, 1 FTE
GS-0025 Park Ranger, .3 FTE

PROPOSED PROGRAM EMPHASIS

Special Directive 80-1 sets standards for preservation, protection, and documentation for museum property. Grand Canyon National Park does not meet many of these basic requirements. Information is lacking from museum and library collections which would assist park staff and researchers in completing research projects as well as assist in preventing duplication of effort if previous work is available for review.

Goal #1: Provide Protection to Museum Artifacts. Museum artifacts are currently stored in a variety of areas including old wooden sheds. To provide basic environmental, pest, and security protection to the museum artifacts, the new museum storage and research facility should be completed so that objects can be moved out to the sub-standard storage areas into a facility which was designed to meet Special Directive 80-1 requirements. Staffing must also be increased so that there is the personnel needed to provide the routine care to the collection (GRCA-C-230.000 through 230.022, GRCA-C-200.002)

Goal #2: Provide Care and Access to the Collections. Personnel and supplies are needed to provide the required levels of care and maintenance to the collection. This

includes providing the staff necessary to perform routine housekeeping, pest monitoring, and environmental monitoring tasks. To fully tap the information potential stored within the collection, the objects must be fully inventoried, catalogued, and entered into the computer. Unless these tasks are accomplished, information will not be available and utilized by park staff and researchers due to not being able to locate and improperly stored artifacts. (GRCA-C-200.000 through 210.028, GRCA-C- 240.000 through 240.019)

Goal #3: Provide a Quality Research Facility on Grand Canyon for Park Staff and Visiting Researchers. The museum collection is missing research and information material and sources which would help to provide complete information to park staff and researchers completing projects on the canyon's cultural and natural histories. Material should be collected from many sources and made available on the canyon. (GRCA-C-210.021, GRCA-C-220.000 through 220.030, GRCA-C-240.020, GRCA-C-310.000 through 310.020, GRCA-C-500.000 through 500.040, GRCA-C-500.050)

PROJECT STATEMENT OUTLINE

GRCA-C-200.000	MUSEUM COLLECTION MANAGEMENT PROGRAM
GRCA-C-200.001	Provide Curatorial Cyclic Maintenance
GRCA-C-200.002	Provide Base Funding for Museum Collection
GRCA-C-200.003	Collection Management Plan
GRCA-C-210.000	MAINTAIN THE MUSEUM COLLECTION
GRCA-C-210.020	Inventory of Museum Collection
GRCA-C-210.021	Microfiche Museum Collection Materials
GRCA-C-210.023	Develop Photographic Documentation of the Museum Collection
GRCA-C-210.024	Computerization of the Museum Collection
GRCA-C-210.028	Catalog Backlog of Museum Specimens

GRCA-C-220.000	MAINTAIN ORAL HISTORY PROGRAM
GRCA-C-220.018	Protect Oral History Collection
GRCA-C-220.020	Collect oral history interviews with CCC workers.
GRCA-C-220.030	Develop oral history program.
GRCA-C-230.000	IMPROVE MUSEUM COLLECTION STORAGE
GRCA-C-230.016	Develop Fire Protection and Security for Museum Collections
GRCA-C-230.017	Complete Historic Boats Storage Facility
GRCA-C-230.022	Construct new museum storage facility.
GRCA-C-240.000	MAINTAIN HISTORIC PHOTOGRAPH COLLECTION
GRCA-C-240.019	Maintain Photograph Collection
GRCA-C-240.020	Obtain copies of photographs in other collections.

Historic Resources Management Program

INTRODUCTION

Historic resources are cultural resources which have been determined to have significance within some historic context, or theme, of the park lands. The significance has been achieved during the historic period, as opposed to the prehistoric time period. Resources include districts, sites, buildings, structures, and objects. Their significance is determined through research.

At Grand Canyon National Park, programs are in place for these types of resources. See the appropriate sections on Museum Collections Management, Cultural Landscape Management, Archeological Resources Management and Historic Structures Management Programs. However, to date there has been no focused effort on documenting resources associated with the broad historic contexts that have been identified for the park.

PROGRAM OBJECTIVES

The overall goal is to meet the basic requirements outlined in NPS-28, the Cultural Resources Management Guideline regarding historic resources. In addition to laying out the research, planning and stewardship guidelines, NPS-28 calls for compliance with laws and regulations applicable to cultural resources.

Research

Resource Identification, Evaluation and Registration: Section 110 of NHPA requires park managers (and all federal agencies) to establish programs to locate, identify and nominate all properties that appear to qualify for the National Register of Historic Places.

Two standard reports for such research are the Historic Resources Study and the Special History Study. The findings and conclusions of those studies form the basis for a historic resources inventory.

Additional research is performed based on the type of resource. Buildings and landscapes are carefully documented, objects are analyzed for physical make-up, etc.

Planning

Planning for historic resources consists primarily of developing treatments for identified resources and integrating such treatments into other park planning processes. It involves planning for the completion/application of these treatments, as when a new facility for the storage of historic objects has been identified for the way of delivering the preservation treatment for objects. In addition, NPS-28 calls for the completion of a number of basic documents as part of the cultural resources planning process.

Stewardship

Carrying out those treatments, providing for the interpretation and use of those resources in appropriate ways.

ISSUES AND SYSTEMWIDE ISSUE CATEGORIES

Currently, Grand Canyon National Park is lacking basic baseline data concerning many of its historic resources. As with other aspects of cultural resources management, informed management and planning decisions cannot be made without such basic data (C02, C03, C04, C07, C08, C10).

There has been insufficient staff and funding

to conduct the research and prepare the documents required of a historic resource management program (C05, C06, C09, C11).

CURRENT PROGRAM

There is no park historian, historical architect, historical landscape architect or ethnographer. Few contracts have been funded for certain projects under this program (National Register Form). A cooperative agreement with Northern Arizona University has yielded some trail studies. A Historic American Engineering Record (HAER) study on roads has been initiated.

Oral histories which would reveal a great deal about Grand Canyon's past have been lost as people have passed away. Many oral histories which would reveal critical information about the period of intense development at the south rim during the 1930's can still be collect and documented while many CCC members are still alive. The ethnography program would be greatly enhanced by these oral histories.

PROPOSED PROGRAM EMPHASIS

Ensure Basic Data Collection and Dissemination

It is imperative that basic information on historic resources be gathered to fully understand the human history of the Grand Canyon. Basic data for historic resources is gathered through a number of sources including, but not limited to, Historic Resources Studies, Cultural Landscape Reports, Ethnographic Studies, Administrative Histories, Special Historic Studies (Project Statement No.'s _____).

Develop Administrative Histories Program

According to NPS-28, "each unit of the park system should have a park administrative history....This document should be prepared or updated for those areas that are scheduled for preparation of management planning." The GMP for Grand Canyon National Park is in its third year of preparation, and there is no administrative history for the park. Information about past planning decisions is not in one place and readily available to help develop solutions to problems being addressed in the current planning effort (Project Statement GRCA-C-310.014).

In addition Grand Canyon has been a park in the forefront of Natural resources management. An administrative history of that program would help present day managers who could learn from what has been done and tried in the past in Natural resources management. Presented in a narrative format, that information could also assist other agencies and parks throughout the world hoping to model their programs upon the United States National Park Service (Projects Statement GRCA-C-310.020).

Prepare Historic Resource Studies

Historic Resource Studies (HRSs) are prepared to identify and evaluate National Register eligible programs. Study, using primary and secondary sources, produces three documents: the HRS itself, a historic resources base map, and National Register nomination forms for those properties not already on the National Register. Aspects of Grand Canyon's history which have yet to be addressed in an HRS include: the Atchison, Topeka and Santa Fe Railroad and its predecessors; NPS development at the Grand Canyon; development of tourism on the North Rim; and mining in Grand Canyon National Park (Project Statements GRCA-C-

320.001, GRCA-C-320.004, GRCA-C-320.005, GRCA-C-320.006).

Support Planning Efforts

Awareness of the park's historic resources at the start of the planning process will/should avoid last minute changes in plans to accommodate the need to preserve historic resources. Areas to be affected by planning decisions where historic resource information is lacking should be given research funding at the start of a planning process so the information is gathered in a timely manner and used to guide and support the planning decisions (Project Statement GRCA-C-310.014).

Cultural Landscapes Management Program

INTRODUCTION

In the broadest sense, a cultural landscape reflects human adaptation and use of natural resources. This is often evident in the division and organization of the land, the presence of both natural and cultural biotic features, the systems of circulation that allow movement, and the types of structures that are built. The character of a cultural landscape is defined by physical material, use and function. Individual features, such as roads, buildings, walls and vegetation are material components that, taken together, create the whole landscape. Patterns of use and function reflect cultural values and traditions.

Specifically, Grand Canyon's program for managing cultural landscapes includes only those landscapes associated with historic structures and districts within existing developed areas of the park. These are the resources most subject to visitor use, impact and change:

SOUTH RIM

Grand Canyon Village Historic District
Rim Trail
East Rim Drive and Overlooks
West Rim Drive and Overlooks
Yavapai Point Museum
Indian Watchtower at Desert View
Hermit's Rest
Tusayan Museum
Grandview Mine Historic District

NORTH RIM

North Rim Inn Historic District
Grand Canyon Lodge Historic District
North Rim Headquarters

CORRIDOR TRAILS

Cross Canyon Corridor Historic District
(Bright Angel Trail, South Kaibab Trail,
connecting River Trail, North Kaibab Trail,
Phantom Ranch Complex, Cottonwood
Campground)

TUWEEP

Ranger Station Complex

Management

Managing a landscape as a cultural resource begins with identifying its character-defining features and understanding them in relation to each other and to significant historic events, trends, and persons. In many cases these features are dynamic in nature and change over time. In many cases, too, historic significance may be ascribed to more than one stage in a landscape's physical and cultural evolution. Landscape management involves identifying the type and degree of change that can occur while maintaining the character-defining features.

The identification and management of an appropriate level of change in a cultural landscape is closely related to its significance. In a landscape significant for its association with a specific style, individual, trend, or event, change may diminish its integrity and needs to be carefully monitored and controlled. In a landscape significant for the pattern of use that has evolved, physical change may be essential to the continuation of the use. In the latter case, the focus should be on perpetuating the use while maintaining the general character and feeling of the historic period(s), rather than preserving a specific appearance (*NPS-28, Chap.7, p.95*).

PROGRAM OBJECTIVES

According to federal law (*see appendix "x" for listing of regulations, laws and policies*) and the *NPS Management Policies*, all cultural landscapes are to be managed as cultural resources, regardless of the type or level of significance. Cultural landscape management focuses on preserving the landscape's physical attributes, biotic systems, and use when that use contributes to its historical significance. Research Planning and stewardship are the framework for the program. Research defines the features, values and associations that make landscapes historically significant; **planning** outlines the issues and alternatives for long-term preservation; and **stewardship** involves activities such as maintenance, condition assessment and training (*NPS-28*).

Research

The primary purpose of research on cultural landscapes is to define the values and associations which make them historically significant. Research findings provide information for management decisions and actions extending from the development of long-term plans to compliance with preservation law and maintenance; assist in determining appropriate treatment; and support interpretive programs.

1. **Identification**: Section 110 of the National Historic Preservation Act requires that the NPS identify and nominate to the National Register of Historic Places all resources under its jurisdiction that appear eligible, including cultural landscapes (*NPS-28*).

2. **Documentation, Evaluation and Registration**: Baseline documentation includes maps, plans, drawings and photographs, as well as intensive field and records investigations to determine the extent and condition of historic and contemporary landscape features. Significance and integrity of the resource are analyzed and evaluated.

Finally, cultural landscapes are listed in the National Register when their significant cultural values have been documented and evaluated within appropriate thematic contexts and physical investigation determines that they retain integrity. This information is documented in a **Cultural Landscape Inventory** (*NPS-28*).

3. **Cultural Landscape Report (CLR)**: A CLR is prepared, as a result of an adequate documentation and evaluation of a landscape, according to *National Register Bulletin 30*. It is prepared by a qualified professional and its findings are incorporated into the National Register. All field notes, primary documents, original maps, drawings, photographs, etc., gathered or associated with the research for CLRs are organized and preserved as archival material or museum objects in consultation with the park curator. All information regarding the condition assessment of character-defining landscape features is incorporated in the Inventory and Condition Assessment Program (ICAP). (*NPS-28*)

Planning

1. **Relationship to Park Plans**: Cultural landscapes often influence proposals in a park's SFM, GMP, DCP(s), RMP, and IP. Cultural landscape issues, such as historic land uses and the location and character of significant resources should be considered in the development of all planning documents to avoid adverse effects on landscapes. Appropriate siting of wayside exhibits and signs and techniques for cultural landscape interpretation should be addressed in the interpretive prospectus. (*NPS-28*)

2. **Decisions About Treatment**: Information regarding the significance and integrity of cultural landscapes is required before decisions about planning and treatment are made, as well as for many activities associated with

park operations (NPS-28).

3. **Compliance:** In Section 106 of NHPA compliance, particular attention must be given to identifying and evaluating landscapes and their character-defining features and uses so that the effects of proposed undertakings on them can be adequately considered (NPS-28).

4. **Use:** Contemporary use of a cultural landscape is appropriate (1) if it does not adversely affect significant landscape features, and (2) if it either follows the historic use or does not impede public appreciation of it. (NPS-28).

Stewardship

Treatment of cultural landscapes is traditionally divided into four categories: **preservation, rehabilitation, restoration and reconstruction.** Standards and philosophies for treatment and management are identified on page 104, Chapter 7, in NPS-28.

ISSUES and SYSTEMWIDE ISSUE CATEGORIES

The major issues and threats facing cultural landscape management in Grand Canyon today consist of incremental direct and indirect changes due to human-caused impacts and also proposed changes for contemporary use of the resource (C12, C13, C18, C19, C21, C23, C24). There is a lack of baseline information and documentation to develop a strong cultural landscape management program (C08, C11).

Specifically, increased visitation has caused trampling and incremental degradation of vegetation, walls, walkways, structures and site features. These areas have become eyesores and sometimes safety hazards and are the subject of both concession and NPS

discussions for immediate treatment and "beautification". In some cases, such impacts and even proposed treatment have preceded any evaluation, and character-defining features may have been lost.

In addition to these site-specific impacts, NPS planning and construction programs have incrementally changed or have proposed changes to these landscapes. The FHWA program has changed circulation systems and small scale elements within cultural landscapes. These changes have occurred with some acknowledgment of the presence of significant cultural landscapes, but the fast-paced program has not accommodated Cultural Landscape Inventories and Report to ensure adequate treatment.

The park's current General Management Plan effort has focused its efforts on changing visitor use within the various park historic districts. The plan's alternatives particularly show major changes in land use and circulation for the Grand Canyon Village Historic District on the South Rim. These changes will radically improve visitor-use management, and thus visitor-experience, on the South Rim. The cultural landscape will be affected by these changes, although it is not known at this time how much. This cultural landscape in particular has recently come to the attention of the historic preservation community as being one of the earliest, most ambitious and most significant examples of 1920's American Town Planning, which also appears to have integrity. This cultural landscape may be eligible for National Historic Landmark designation.

However, this cultural landscape, as well as most other cultural landscapes, does not have adequate documentation and evaluation of character-defining features. Therefore, in assessing the impact of proposed actions, all built and natural features within the

boundaries of a nomination will be considered contributing to the significance of the property until properly evaluated and determined otherwise. Such a consideration may impede and confuse current planning efforts, resulting in potential adverse impacts.

A Cultural Landscape Report (CLR) must be done prior to physical alterations to cultural landscapes in the park...*"No treatment is undertaken without an approved CLR or work procedure documenting the work and Section 106 compliance..."* (NPS-28, pg 106).

CURRENT PROGRAM

There is no Historical Landscape Architect on staff at present. Although the park landscape architect may have an interest and background in cultural landscapes, with the many other duties assigned to that position, cultural landscapes do not receive the proper attention.

Because of the current lack of a Historical Landscape Architect at the Western Regional Office, guidance for such projects has been under the purview of the Regional Historical Architect, who has had a special interest and some knowledge in cultural landscape preservation.

One Cultural Landscape Inventory for Phantom Ranch and one Cultural landscape Report for the South Rim Housing Area have been developed within the past four years. However, many changes to other cultural landscapes have taken place, and continue to take place without the proper analysis.

PROPOSED PROGRAM EMPHASIS

In light of the urgency of both the FHWA program and the GMP, GRCA's cultural landscape program emphasis will be geared

towards providing direction, recommendations and NHPA compliance for these projects and their implementation. Treatment of areas impacted by increased visitation will also be addressed. The following goals and subsequent strategies reflect this emphasis:

GOAL #1: PROVIDE DIRECTION FOR APPROPRIATE TREATMENT OF CULTURAL LANDSCAPES IN IMPLEMENTING THE GMP

The comprehensive design(s) which implement the concepts set forth in the GMP will be accomplished using an interdisciplinary team of historical landscape architect(s), historical architect(s) as well as planners and designers. Site plans which integrate Natural and cultural resource concerns will be developed according to recommendations set forth in associated CLR(s) for those areas. This is critical in order to mitigate any adverse impacts and to preserve character-defining features. (GRCA C330.001, GRCA C 334.000 through GRCA C 334.018, GRCA C333.000)

GOAL #2: PROVIDE DIRECTION FOR THE APPROPRIATE TREATMENT OF CULTURAL LANDSCAPES ASSOCIATED WITH IMPLEMENTATION OF THE CURRENT FHWA PROGRAM

CLR(s) will be developed prior to the alteration of cultural landscapes by the FHWA program. These CLRs will recommend ways in which changes to circulation systems may occur without loss of character-defining features of the cultural landscape(s). Design teams are recommended to be interdisciplinary, with inclusion of a historical landscape architect, to ensure an integrated natural and cultural resource

preservation approach. (GRCA C330.001, GRCA C 334. 000 through GRCA C334.008, GRCA C333.000)

GOAL #3: INVENTORY CULTURAL LANDSCAPES AND MANAGE INFORMATION ACCORDING TO PARK'S STANDARD OPERATING PROCEDURE

All information regarding the condition assessment of character-defining landscape features will be incorporated in the Inventory and Condition Assessment Program (ICAP). All field notes, primary documents, original maps, drawings, photographs, etc., gathered or associated with the research for CLR's are organized and preserved as archival material or museum objects in consultation with the park curator. (GRCA C332.000, GRCA C333.000)

GOAL #4: INCORPORATE CLR RECOMMENDATIONS INTO ASSOCIATED VEGETATION MANAGEMENT PLANS

Historically appropriate vegetation shall be used where vegetation management plans address cultural landscapes. Where historically appropriate yet exotic species are not feasible, selection of native species shall preserve character-defining features identified in the associated CLR. An integrated resource management approach, using a cultural landscape based site plan and document can more comprehensively preserve all significant resources in such areas. (GRCA C330.001, GRCA C334.000 through C334.018)

GOAL #5: PROVIDE DIRECTION IN THE TREATMENT OF CULTURAL LANDSCAPES ASSOCIATED WITH THE IMPLEMENTATION OF THE

PARK'S VISUAL QUALITY ENHANCEMENT PROGRAM

NPS and concession maintenance activities as well as park architectural guidelines shall follow guidelines and recommendations developed in a CLR associated with that particular cultural landscape. Again, no treatment is undertaken without an approved CLR or work procedure documenting the work and NHPA compliance. (GRCA C330.001, GRCA C334.000 through GRCA C334.018)

GOAL #6: IDENTIFY AND NOMINATE CULTURAL LANDSCAPE RESOURCES TO THE NATIONAL REGISTER OF HISTORIC PLACES

As required by Section 110 of the National Historic Preservation Act. It is important for park management to understand what and where their cultural landscape properties are, and to understand how to integrate their proper management with other park programs. (GRCA C331.000)

PROJECT STATEMENT REFERENCES

GRCA-C-330.000	CULTURAL LANDSCAPE MANAGEMENT PROGRAM
GRCA-C-330.001	Establish Historical Landscape Architect Position
GRCA-C-331.000	Identify and Nominate Cultural Landscapes to NRHP
GRCA-C-332.000	Inventory Cultural Landscapes
GRCA-C-333.000	Implement Cultural Landscape Information Management Program
GRCA-C-334.000	DEVELOP CLR(S) FOR ALL PARK CULTURAL LANDSCAPES
GRCA-C-334.001	Develop CLR for Grand Canyon Village
GRCA-C-334.002	Develop CLR for East Rim Drive and Overlooks
GRCA-C-334.003	Develop CLR for West Rim Drive and Overlooks
GRCA-C-334.004	Develop CLR for Hermit's Rest Area
GRCA-C-334.005	Develop CLR for Watchtower Area at Desert View
GRCA-C-334.006	Develop CLR for North Rim Inn Area
GRCA-C-334.007	Develop CLR for North Rim Headquarters Area
GRCA-C-334.008	Develop CLR for Grand Canyon Lodge Historic District
GRCA-C-334.009	Develop CLR for Tuweep Ranger Station Area
GRCA-C-334.010	Develop CLR for Bright Angel Trail
GRCA-C-334.011	Develop CLR for South Kaibab Trail
GRCA-C-334.012	Develop CLR for Corridor River Trail
GRCA-C-334.013	Develop CLR for North Kaibab Trail
GRCA-C-334.014	Develop CLR for Phantom Ranch Area
GRCA-C-334.015	Develop CLR for Cottonwood Campground Area
GRCA-C-334.016	Develop CLR for Rim Trail
GRCA-C-334.017	Develop CLR for Tusayan Museum Area
GRCA-C-334.018	Develop CLR for Yavapai Point Museum Area

Historic Structures Management Program

INTRODUCTION

A structure is a "*constructed work.....consciously created to serve some human activity.*" Structures are usually immovable, although some have been relocated and others are mobile by design. They include buildings and monuments, dams, millraces and canals, nautical vessels, bridges, tunnels and roads, railroad locomotives, rolling stock and track, stockades and fences, defensive works, temple mounds and kivas, ruins of all structural types, and outdoor sculpture. In this section, the program will be specific to those structures that are historic (not prehistoric) in nature. Prehistoric resources are discussed in the archeology and ethnography sections of this document. Cultural Landscapes and their elements are discussed in that program section. (NPS-28)

Grand Canyon's historic structures represent the Anglo-inhabitation of the canyon, since _____, which brought to the region the heritage of the great western frontier and tourism. The park's historic properties include 120 buildings listed as National Landmarks, 136 listed on the National Register of Historic Places and an additional 229 properties on the List of Classified Structures. The appendix lists these properties by building number.

PROGRAM OBJECTIVES

According to both federal law and NPS Management Policies, all historic structures in the park are to be managed as cultural resources. Regardless of type, level of significance, or current function, every structure is to receive full consideration for its historic values whenever a decision is made that might affect its integrity. (NPS-28)

The preservation of historic structures involves two basic concerns: slowing the rate at which historic material is lost, and maintaining historic character. Research on, planning for, and stewardship of historic structures focus on these concerns. *Research* defines historical associations, integrity, character, and the causes of material deterioration; *planning* develops and evaluates proposals for use and treatment in terms of their likely effects; and *stewardship* entails activities ranging from craft training to the identification and mitigation of threats. (NPS-28)

Preservation of historic structures is an interdisciplinary effort requiring cooperation and communication among historical architects, architectural conservators, preservation specialists, archaeologists, (historical) landscape architects, historians, ethnographers, and curators. The regional historical architect oversees all preservation treatment for historic structures. (NPS-28)

RESEARCH

Research about historic structures is a prerequisite for treatment and provides a basis for decision-making by managers. It also contributes to interpretation, compliance and facility design.

1. Identification Evaluation, and Registration: Section 110 of the National Historic Preservation Act requires the NPS to identify and nominate to the National Register of Historic Places all structures under its jurisdiction that appear to qualify for the National Register. Often tools for identification, evaluation and registration include:

Historic Resource Study (HRS): the

primary document used to identify and manage the cultural resources in the park.

National Register Nominations: may be prepared either for individual structures or for groups of structures, as well as for landscapes.

List of Classified Structures (LCS): LCS is inventory of all structures which are on or eligible for the National Register. LCS also refers to the computerized database containing information about historic and prehistoric structures.

Categories of Significance: categories used to establish LCS management categories, determine appropriate levels of recordation, and make other related management decisions.

2. **Documentation and Investigation:** As a rule, research about a historic structure should complement existing information and strive to produce a comprehensive understanding of the structure in order to adequately address management concerns. Documentation includes:

Historic Structures Report (HSR): the primary guide to treatment and use of a historic structure; in no case should restoration, reconstruction, or extensive rehabilitation of any structure be undertaken without an approved HSR

Graphic Documentation: to record preservation treatment, provide a baseline for monitoring, aid in interpretation, support scholarly research, and serve as an objective reference for repair or reconstruction in the event of damage or loss

ICAP

HABS/HAER

Archival Considerations: to maximize the benefit of research and investigation and minimize potential data loss, all field notes, primary documents, original maps, drawings, photographs, and material samples generated should be organized and preserved as archival material or museum objects in consultation with the park curator

PLANNING

Planning for historic and prehistoric structures encompasses such diverse activities as involvement in park planning, facility design, preparation of maintenance work procedures, and compliance. The central purpose of all such activities is to identify ways of protecting cultural resources while achieving other management objectives. This is usually best done by a thoughtful evaluation of a diverse range of alternatives. Action plans that may affect historic structures should include furnishing reports and cultural landscape reports. Treatment and use are the central issues in planning for historic structures:

Treatment Planning: (a) preservation of existing materials, (b) replication of missing historic features, (c) addition of non-historic features and/or (d) removal of existing features or materials. Decisions about the ultimate treatment of a historic structure should reflect the value of a structure as a cultural resource, knowledge of craft techniques and building materials, consideration of current and intended uses, appreciation of threats to the structure, and projections of treatment costs relative to likely funding: preservation, rehabilitation,

restoration, or reconstruction.

Historic Property Preservation Database (HPPD) is a computerized database containing technical information on the treatment of historic and prehistoric structures and cultural landscapes. It contains work procedures for the Inventory and Condition Assessment Program (ICAP) and the Maintenance Management System Program (MMS).

Removal or neglect is justifiable only when all alternatives have been determined infeasible in the planning process. *NPS Management Policies* prohibit demolition unless necessary for public safety or to eliminate an unacceptable intrusion. No structure listed in or potentially eligible for the National Register will be removed or deliberately neglected without review and approval by the regional director and State Historic Preservation Officer (SHPO). Documentation recording it must be prepared in accordance with Section 110(b) of the National Historic Preservation Act and must be submitted to and accepted by the Chief, HABS/HAER Division, WASO.

Use of Historic Structures: the primary preservation issue is the compatibility of the use with the structure. Considerations include wear patterns, adequacy of space and spatial configurations, the need for new electrical or mechanical systems, increase in fire risk, and changes necessary to accommodate disabled employees or visitors.

Compliance: All project plans for historic and prehistoric structures must be reviewed for compliance with Section 106 of the National Historic Preservation Act. Buildings over fifty years old must be determined eligible or ineligible for the National Register as a first step in the compliance process.

Funding and Staffing: Every treatment project, including preservation, is initiated by a programming document containing cost estimates and a scope of work. This information should be drawn from the Inventory and Condition Assessment Program (ICAP) or an approved HSR.

STEWARDSHIP

For historic structures, stewardship focuses on five major activities: (a) control of treatment and use, (b) monitoring conditions of deterioration and structural failure, (c) protecting structures from human and environmental threats, (d) retaining or delegating responsibility for structures, and (e) developing skills, knowledge, and attitudes needed to support the program. These are discussed at length in NPS-28.

ISSUES and SYSTEMWIDE ISSUE CATEGORIES

The biggest threat to historic structures concerns the lack of a strong preservation program. The inherent lack of baseline information, inventory and understanding of these structures leads to an unclear direction for building use and preservation. The lack of a systematic, programmatic approach to rehab, reuse, maintenance, emergency repair is the biggest threat to these structures (C05, C06, C07). There is no permanent professional expertise on staff as a position to address these issues (C24).

For this reason, the park uses an approach which only responds to other programs, or in other words, is in crisis management. Life/safety and accessibility issues, Integrated Pest Management (IPM) issues, increased visitation, lead abatement and asbestos removal, the Housing Initiative and other urgent programs are driving the direction or, rather the lack of direction of historic

structures preservation (C17, C18, C19).

Funding for planning, design and construction is available for Federal Highways projects and for the current GMP. However, there is currently no funding available to inventory, evaluate and develop a systematic, programmatic approach to preserve and maintain structures. Various concessioners often have ideas, needs and funding available to address those needs within a budgetary time period. Compliance for these disjointed agendas is reactionary and frustrating for both the compliance staff and for the DSC or concession staff (C10, C23).

Preventative maintenance is an unfunded element at Grand Canyon. There are no preservation crew or preservation specialists at Grand Canyon. Currently, the park maintenance division is understaffed and underfunded as a whole. They, too, react to various crisis that develop almost on a daily basis. They must keep roads clear, offices functional and safe, houses occupied and utilities operational. In the process, some rehabilitation or maintenance of historic structures must be accomplished, but again, it is done in a piecemeal fashion (C12, C13, C21).

Finally, there is an inherent lack of understanding and respect for historic structures and districts at Grand Canyon (C25, C26). It is easier for most staff and public to understand the careful treatment of the grand El Tovar hotel or historic railroad depot, than the historic houses, cabins and maintenance facilities. The latter represent buildings that are seen as old, decrepit and obsolete. Their value is not communicated nor understood by most park staff and the public. This leads to a misconception that these buildings have no value and should thus be treated as such. It is even more frustrating to lay-persons when compliance for what

they feel are minor modifications is slowed by the lack of a strong preservation program and baseline data. A strong interpretation, education and communication program will bridge this gap between preservation specialists and lay-persons, and foster a more healthy atmosphere for management of these cultural resources.

CURRENT PROGRAM

For the past two years, there has been a temporary GS-07 architect on staff who has been hired with funding from the historic housing lead abatement program. This individual has developed guidelines and plans for the rehabilitation of these houses in compliance with Section 106. However, the _____ other historic structures in the park have received little or no attention for the past six years. The historical architect position was vacated and lost in 1988. Various projects that propose and implement rehabilitation or change to individual structures have been approached on an ad-hoc basis, with no overall professional guidance. The existing compliance coordinator position is occupied by an individual with historic structures and preservation background, but the coordinator is also responsible for other NEPA compliance activities in the park. Compliance alone does not constitute a preservation program.

PROPOSED PROGRAM EMPHASIS

In light of these issues, it is clear that the single most important charge for the management of historic structures is the development of a systematic, programmatic approach to rehabilitation, reuse, maintenance and emergency repair of these structures. Therefore, the primary emphasis for the GRCA historic structures program is to develop a strong preservation program.

GOAL #1: CONDUCT RESEARCH NECESSARY FOR A COMPREHENSIVE UNDERSTANDING OF THE PARK'S HISTORIC STRUCTURES

This program should address the *research* necessary to satisfy Section 110 of the National Historic Preservation Act which involves the identification, evaluation and registration of Structures (HRS's, National Register Nominations, LCS, and categories of significance. Documentation and investigations necessary to produce a comprehensive understanding of the structure(s) is key to adequately address management concerns (HSR's, graphic documentation and archival considerations).

GOAL #2: DEVELOP TREATMENT PLANS AND USE/ADAPTIVE REUSE PLANS FOR PARK'S HISTORIC STRUCTURES

Using the Historic Property Preservation Database (HPPD), the Inventory and Condition Assessment Program (ICAP), and the Maintenance Management System (MMS), develop treatment plans for the park's historic structures. Ensure that proposed or existing use of historic structures is compatible with preservation of that particular building(s). Through an interdisciplinary team comprised of historical architects, historical landscape architects as well as planners and designers, provide direction for the use and adaptive reuse of historic structures. Pertinent projects include the current GMP, and FHWA projects.

GOAL #3: DEVELOP AN ADEQUATE COMPLIANCE PROGRAM

Develop a compliance program in order to meet policies, mandates, guidelines and standards concerning the treatment of historic structures.

GOAL #4: PROVIDE ADEQUATE

FUNDING AND STAFFING FOR AN ADEQUATE HISTORIC STRUCTURES PRESERVATION PROGRAM

Staffing should include the expertise required to develop plans and initiate compliance, as well as a preservation crew to implement the preservation program. Funding should be adequate to meet the minimum standards of this preservation program.

GOAL #5: DEVELOP A STRONG EDUCATIONAL AND INTERPRETIVE PROGRAM WHICH COMMUNICATES THE VALUE OF GRCA'S HISTORIC STRUCTURES TO BOTH VISITORS AND STAFF

NO OUTLINE YET, THIS IS BEING REVIEWED and ENHANCED BY HANK FLORENCE AND DOUG BROWN.....

Archaeological Resources Management Program Overview

INTRODUCTION

Archaeological resources are defined as those physical remains that provide the basis for understanding and interpreting prehistory and history. They include prehistoric and historic period sites and materials found in museum collection.

At Grand Canyon, the past is represented by over 2700 known archaeological sites, dating from as early as 10,000 years ago to as recent as 50 years ago. With approximately 2% of park lands systematically surveyed for archaeological remains, we estimate that our resources may total over 50,000.

The archaeological resources of Grand Canyon encompass a wide variety of cultural remains indicating use of the canyon by people over the last 10,000 years. A single fragment of a Paleo-Indian projectile points suggests limited use by big-game hunters at the end of the Pleistocene period nearly 10,000 years ago. Archaic hunter-gatherers left small, split-twig figurines in caves in the Redwall limestone nearly 4000 years ago. Small campsites, projectile points and rock art provide further evidence of the Archaic tradition at Grand Canyon.

People moved in and out of Grand Canyon, leaving behind evidence of their lives here. Thousands of dwellings, shelters, and agricultural terraces have been located, providing evidence of ancestral Pueblo farmers living on both rims and in the inner canyon. Pottery, chipped stone, ground stone, and other artifacts remain to help tell the story of these people and their passing through the canyon between 800 and 1200 years ago.

Other people lived here too, people known as

the Cohonina. While they did not build the same types of dwellings as their Pueblo neighbors, they, too, left remains of their houses, abandoned some 800 years ago. Cerbat peoples moved into the canyon 600 years ago, occupying areas today used by their descendants, the Hualapai and Havasupai.

The Hopi, Zuni, Southern Paiute and Navajo all left remains that have become part of the archaeological record. These same people continue to use the canyon today for traditional and religious reasons.

In addition to the prehistoric and historic Native American archaeological legacy, Euro-American history, from the time of contact in 1540 through development of the NPS is represented in the archaeological record. The majority of the historic archaeological record comprises evidence of early exploration (John Wesley Powell and Robert Brewster Stanton), exploitation (early mining sites from Ralph Cameron, Pete Berry, William Wallace Bass, and John Hance), and tourism (Grandview and Buggeln Hotel sites, Hance Ranch, and Bass Camp).

LAWS AND POLICIES

The management of archaeological resources is mandated by law and policy. Of particular importance to archaeological resource management are specific NPS laws and regulations, NPS Management Policies, the Antiquities Act (1906), the National Historic Preservation Act of 1966 (as amended 1992), the Archaeological Resources Protection Act of 1979 (as amended 1988), and the Native American Graves Protection and Repatriation Act of 1990.

The management of the archaeological

resources of Grand Canyon is based upon the guidelines established in NPS-28. These guidelines outline 3 principal areas:

1. Research, to identify, evaluate, and establish other basic information about archaeological resources;
2. Planning, to ensure that this information is well integrated into management processes for making decisions and setting priorities; and
3. Stewardship, under which planning decisions are carried out and resources are preserved, protected, and interpreted to the public.

PROGRAM OBJECTIVES

According to NPS Management Policies, "*The NPS will conduct a coordinated program of basic and applied research to support planning for and management of park cultural resources*" (NPS-28, 1993:21).

The primary objective of Grand Canyon's archaeological resource management program is to meet the basic requirements as outlined in NPS-28 to ensure that archaeological resources in Grand Canyon are identified and preserved. This is done through a systematic program of research (inventory, evaluation, professional documentation, registration), planning, and stewardship (monitoring, protection, treatment, and interpretation).

Research

Identification and evaluation of archaeological resources is essential to informed decision-making for park maintenance, visitor services and development. The National Register of Historic Places criteria for evaluating historic and prehistoric properties are fundamental to

this process. Without basic inventory data on resources, park planning processes cannot provide for their protection. Research must meet the Secretary of the Interior's Standards for Archaeology and Historic Preservation.

1. Resource Identification, Evaluation, and Registration

Section 110 of NHPA requires park managers, in consultation with SHPO, to establish programs to locate, inventory, and nominate to the National Register all properties that appear to qualify for the Register. Research begins by locating and evaluating cultural resources. Research should be driven by management concerns.

2. Documentation in Service-wide Inventories

All archaeological resources must be entered into the appropriate service-wide inventories, primarily the CSI and ASMIS. All field data must be maintained and catalogued through ANCS, ASMIS and CSI. Base maps must be maintained and updated for all projects showing the location and distribution of park archaeological resources and the nature and extent of archaeological identification studies. Archaeological site information is provided to the State Historic Preservation Officer, as appropriate. All sites are evaluated using National Register criteria and nominated to the Register if they appear eligible.

3. Reports

Reports are prepared to meet planning and management needs and professional standards are met. Research results are disseminated for use in the interpretation of archaeological resources. Reports are accurate, up-to-date, relevant to park themes, and consistent with resource preservation.

Confidentiality of research information is maintained as identified in both ARPA and

NHPA, which authorize withholding from the public information about the location and nature of archaeological resources within national parks to protect them from vandalism, looting, and commercial exploitation.

Planning

Effective archaeological resource management serves to (1) integrate archaeological resource concerns into other park planning and management processes; (2) avoid or minimize adverse effects on archaeological resources; and (3) identify the most appropriate uses for archaeological resources and determine their ultimate treatment (preservation, stabilization, rehabilitation, or restoration). Planning should insure that all compliance is carried out, and all consultation is taken into account in decision-making.

Stewardship

"The NPS Management Policies requires that *"pending planning decisions, all cultural resources will be protected and preserved in their existing conditions."* In reaching decisions about resource treatment, preservation should always receive first consideration. Excavation, rehabilitation, restoration, and reconstruction may serve legitimate management purposes, but these treatments cannot add to and will likely subtract from the finite material and data sources remaining from the past" (NPS-28).

"Archaeological resources are preserved and protected by eliminating and avoiding natural and human impacts, stabilizing sites and structures, monitoring conditions, complying with and enforcing protective laws and regulations, and other means as appropriate" (NPS-28, 1993:94).

ISSUES and SYSTEMWIDE ISSUE CATEGORIES

The major issues and threats facing archaeological resources in Grand Canyon stems from the lack of baseline resource data. Without baseline information, it is impossible to construct a coherent plan to manage these resources (C02, C14).

Degradation from natural processes and increased visitation is effecting the archaeological resources (C13, C18, C19 C24). Increasing visitation to the park, in particular in the backcountry, threatens the very existence of the archaeological resources. Increased visitation, without monitoring or mitigation (due to a lack of staff and funding), exposes archaeological sites to higher rates of general degradation and vandalism. Without basic inventory, not only do we not know where our resources are, but we do not have a mechanism for insuring preservation. These basic issues are core to federal responsibilities under the National Historic Preservation Act, sections 106 and 110, and the Archaeological Resources Protection Act.

Recent changes in legislation have increased our legal responsibilities for both preservation and consultation related to cultural resources. In particular, changes in NHPA and ARPA, and the implementation of NAGPRA require expanded response from park staff, an organization which is woefully understaffed at the present time (C20, C21).

Higher visitation and the lack of baseline data or staff to monitor site conditions brings the potential of increased danger due to hazards at some archaeological and historic sites. These sites, primarily abandoned mines and cowboy camps, contain hazardous materials such as explosives which pose a threat to public and staff health and safety (C21, C26).

Increasing development and the preparation (and implementation) of the park GMP will have an effect on archaeological resources. Without baseline information, decisions are made concerning NPS developments without the necessary resource information which should be used to guide decisions. In addition to the GMP, other park plans, such as the fire management plan, backcountry management plan and river management plan, need basic information concerning archaeological resources to insure that the plans reflect resource concerns and preservation. Full integration of resource concerns should be included in the planning for these programs. Due to our limited database and limited staff, these concerns are often overlooked (C23, C17).

The archaeological resources of Grand Canyon cannot be viewed in isolation from the remainder of the Colorado Plateau (C26). The archaeological record adds much to our understanding of the human role in the changing ecosystem. This must be viewed as part of the larger ecosystem of the Plateau and the data from Grand Canyon is an important component. An Ecosystem Management approach needs to include:

- a) Establishment of partnerships which focus on new roles for park neighbors (plateau communities, agencies, tribes)
- b) A critical need exists to increase our understanding of the human role in changing ecosystems. This involves a greater understanding of the role of technological and cultural knowledge systems in adapting to an ever changing ecosystem. Archaeology provides time perspective needed to understand change in many components of the ecosystem.

Each time an archaeological site is recorded,

our ability to interpret the past to the visitor is greatly improved. The public wants to know, and our understanding of the resources of the park is critical to that exchange of knowledge. Interest by the public in cultural resources (both archaeology and contemporary Indian issues) has seen a dramatic increase. There is a need to expand park interpretation to include these issues with an emphasis on resource preservation (C15, C26).

CURRENT PROGRAM

The current archaeological resource management program is coordinated by the Park Archaeologist and a newly created staff archaeologist position. These two positions, totalling 1.9 FTE, attempt to insure that the archaeological resources of Grand Canyon are preserved and maintained for the future. The majority of the program is focussed on compliance with Section 106 of the National Historic Preservation Act and compliance related to the National Environmental Policy Act. Virtually all inventory surveys conducted in the park are the result of compliance generated actions. Research is done ancillary to compliance projects, although we coordinated a short, research oriented field school with Northern Arizona University in the spring of 1994.

A total of 4.5 additional FTE's are currently dedicated to various compliance projects throughout the park. Two full-time temporary employees are dedicated to the NHPA compliance requirements related Glen Canyon Dam operations. Another 2.5 FTE's are dedicated to compliance projects related to construction and prescribed fire.

Because of the nature of much of the work, inventory surveys have not been accomplished. The inventory we do maintain represents approximately 2% ground survey.

There is no coordinated research design under which the surveys are completed. Survey design at this point in time is generic, related to sample surveys for prescribed fire and complete inventories for construction projects. No funds have been provided for any non-compliance inventory.

Monitoring of archaeological sites along the rims and in the backcountry has been ad-hoc. Coordination is attempted with Visitor and Research Protection personnel. Active ARPA patrols are occurring in the Desert View district, and along the Inner Canyon Corridor. Non-ARPA monitoring is done along the main canyon trails in conjunction with natural resource monitoring.

Monitoring of sites along the Colorado River has been occurring regularly since 1978. Annual monitoring trips are taken every October in conjunction with natural resource monitoring to evaluate visitor and natural impact, recommend remedial actions, and prepare necessary documentation. Additional monitoring of sites along the river is accomplished through the Programmatic Agreement on the effects of Glen Canyon Dam operations.

Cyclic maintenance of masonry ruins has not been an active program due to a lack of funds. We maintain the major interpretive ruins, Tusayan and Walhalla Glades, with volunteer help from other divisions.

Databases are maintained as a component of any field work. However, the computer database is incomplete and considerable work needs to be done to rectify 60 years worth of paper records and maps.

Interpretive information and educational materials are provided by existing staff for both internal and external consumption. Displays are prepared, presentations made,

and brochures created as requested by the Division of Interpretation, Natural History Association, other park staff, and other agencies.

PROPOSED PROGRAM EMPHASIS

The archaeological resources management program is designed to address the threats to the resources and to comply with our legal responsibilities to preserve these resources for the future. Goals for the program include:

GOAL #1: ENSURE BASELINE DATA COLLECTION

It is essential that archaeological inventories be completed to understand the complexity of the resources and to make appropriate management decisions that affect the resources. The basic goal to correct this deficiency is the completion of baseline inventories to establish the database and provide evaluation of resource conditions. (GRCA-C-400.001, GRCA-C-400.002, GRCA-C-440, GRCA-C-430)

GOAL #2: MINIMIZE ARCHAEOLOGICAL SITE DEGRADATION

Archaeological resources are continuously threatened by both natural processes and increased visitation. By allowing this degradation to continue, we are in violation of Section 110 of NHPA and ARPA. Mitigation plans (including site stabilization and use plans) must be developed and implemented to insure that we are preserving the resources entrusted to our care. (GRCA-C-410.001, GRCA-C-410.002, GRCA-C-410.03, GRCA-C-420.001, GRCA-C-420.002, GRCA-C-420.003)

GOAL #3: PROVIDE DIRECTION AND OVERSIGHT FOR OUR INCREASING LEGAL RESPONSIBILITIES FOR BOTH

INTERNAL AND EXTERNAL
PROGRAMS

Legislation, amendments to legislation, regulations, guidelines and NPS Management Policies all require the inventory and preservation of archaeological resources. This body of law and policy has expanded, and continues to increase the need for park planning and compliance documentation and implementation. (GRCA-C-600.000, GRCA-C-610.001, GRCA-C-610.002, GRCA-C-610.003, GRCA-C-620.000, GRCA-C-630.000, GRCA-C-640.000)

GOAL #4: DEVELOP A COLORADO
PLATEAU ECOSYSTEM APPROACH TO
THE MANAGEMENT OF
ARCHAEOLOGICAL RESOURCES

The cultures of the Colorado Plateau do not exist in isolation. Administrative boundaries are arbitrary, and understanding the human role in the changing ecosystem is critical to understanding the system itself. Archaeology provides time perspective and can shed light on many natural resource issues. These need to be viewed from a plateau perspective, not just from the park. (GRCA-C-120.000, GRCA-C-400.001, GRCA-C-400.002, GRCA-C-430.000, GRCA-C-620.000)

GOAL #5: PROVIDE
ARCHAEOLOGICAL SITE
INFORMATION FOR
INTERPRETATION OF PARK
RESOURCES AND VALUES.

Interest by the public in archaeology and contemporary American Indian issues has seen a dramatic increase. There is a need to expand park interpretation to incorporate these issues with an emphasis on resource preservation. One of the most effective means of preservation is education through interpretation. (GRCA-C-400.002, GRCA-C-500.000, GRCA-C-110.005)

PROJECT STATEMENT REFERENCE

GRCA-C-400.000	Archaeological Resources Management Program
GRCA-C-400.001	Develop Parkwide Research Design for Archaeological Resources
GRCA-C-400.002	Implement the Systemwide Archaeological Inventory Program (SAIP)
GRCA-C-410.000	IMPLEMENT COMPREHENSIVE PROGRAM FOR MONITORING ARCHAEOLOGICAL SITES (VISITOR AND NATURAL IMPACTS)
GRCA-C-410.001	Conduct Monitoring of Archaeological Sites within developed areas of the park
GRCA-C-410.002	Conduct Monitoring of Archaeological Sites along backcountry trails
GRCA-C-410.003	Conduct Monitoring of Archaeological Sites along the Colorado River
GRCA-C-420.000	DEVELOP MITIGATION PLANS FOR IMPACTS TO ARCHAEOLOGICAL SITES
GRCA-C-420.001	Develop Archaeological Data Recovery Program
GRCA-C-420.002	Cyclic Maintenance of Masonry Ruins
GRCA-C-420.003	Develop Site Stabilization Plans (non-masonry)
GRCA-C-430.000	FIRE EFFECTS AND ARCHAEOLOGY
GRCA-C-430.001	Assessment of Effects of Management Fires on Archaeological Remains
GRCA-C-430.002	Post-Burn damage assessment for fire rehabilitation program
GRCA-C-440.000	MAINTENANCE OF ARCHAEOLOGICAL DATABASE
GRCA-C-440.001	Convert existing site files into ASMIS
GRCA-C-440.002	Maintain and Update existing site specific site files
GRCA-C-440.003	Maintain and Update base topographic maps of archaeological site locations
GRCA-C-440.004	Convert existing base maps into GIS files
GRCA-C-440.005	Maintain and convert photographic files into computer database
GRCA-C-440.006	Maintain and convert artifact analysis information onto computer database
GRCA-C-500.000	CULTURAL RESOURCES INFORMATION MANAGEMENT PROGRAM
GRCA-C-510.010	Enter Cultural Data into GIS Database
GRCA-C-500.015	Management of Park Library
GRCA-C-500.020	Obtain copies of all GCNHA bibliography material.
GRCA-C-500.025	Obtain copies of Grand Canyon material in other repositories.
GRCA-C-500.030	Information integration with other services
GRCA-C-500.035	CRBIB
GRCA-C-500.040	National Technical Center and National Technical Information

GRCA-C-500.045	System
GRCA-C-500.050	Design and replace the South Rim Visitor Center's Exhibits. Survey and inventory collections for Grand Canyon Natural and Cultural Objects

Ethnographic Resource Management Program

INTRODUCTION

The Ethnography Program provides technical and administrative assistance to all personnel within Grand Canyon National Park. This assistance involves the inventory, management, and protection of ethnographic resources throughout the park.

An ethnographic resource is defined as any natural or cultural resource linked to the traditional practices, values, beliefs, history and/or ethnic identity of a cultural group or groups.

Grand Canyon has been home to various groups of people for thousands of years. These people, both native Americans and more recent Euro-Americans, have utilized the canyon as both a home and a place linked to traditional practices, values and beliefs. To the Hopi and Zuni, the Grand Canyon represents their place of origin into this world. For Hopi, it also represents the place where their spirits come to rest after death.

For the Pueblo people, archaeological remains in the canyon provide evidence for their migration from their place of origin to their present homes. For the Pai people, the canyon and the river are the lands they have been entrusted to care for. The river represents the backbone. For the Southern Paiute, it has always been a part of their world.

Euro-Americans recognized the spiritual values of the canyon in the establishment of the National Park in 1919. World Heritage designation told the world that the Grand Canyon had value beyond just the American people. The 1975 Grand Canyon Enlargement Act specified natural quiet and the view as important, yet intangible qualities,

that must be protected. These, too, are ethnographic resources.

Management

The Ethnographic Resource Management Program seeks to :

- 1) enhance the park's management of its natural resource base by conducting ethnographic research and consulting with park affiliated cultural communities;
- 2) improve the quality of park visitor services by providing accurate information on ethnographic resources within the park; and
- 3) increase the understanding of cultural diversity among park personnel through increased awareness of potential cross-cultural resources issues.

Through the integration and improvement of resource management, visitor experience, and personnel sensitivity, the ethnographic program will raise the level of public and park personnel understanding and appreciation for the area heritage of natural, cultural, and ethnic diversity.

PROGRAM OBJECTIVES

Attention to the peoples whose lifeways are traditionally associated with resources under NPS stewardship is mandated in legislation and NPS policies. According to NPS Management Policies (1988, 5:1):

Certain contemporary native American and other communities are permitted by law, regulation, or policy to pursue customary religious, subsistence, and other cultural uses of park resources with which they are traditionally associated. Such continuing use is often

essential to the survival of family, community, or regional cultural systems, including patterns of belief and economic and religious life. Recognizing that its resource protection mandate affects this human use and cultural context of park resources, the NPS will plan and execute programs in ways that safeguard cultural and natural resources while reflecting informed concern for the contemporary peoples and cultures traditionally associated with them.

Given the direction provided through NPS Management Policies, the program objectives for ethnographic resources can be summarized within the categories of Research, Planning and Stewardship.

Research

1. Develop and implement a professional ethnographic research program to provide data to support sound management of cultural and natural resources. Studies are conducted to identify ethnographic resource inventory data, interpretive uses, and resources with National Register potential as traditional cultural properties.
2. Provide the park with the capability of conducting research to gather baseline data to be used in park resource management plans, consultation plans, compliance documentation and day-to-day decision concerning resource use.
3. Design and implement an automated ethnographic resource data base that can be used by Regional and Park Personnel.

Planning

Ethnography provides perspectives on people and cultural systems affected by proposed or existing parks. It contributes to culturally

appropriate strategies and evaluates consultation results to identify sensitive issues.

1. Consultation with traditionally associated groups is initiated during scoping or early project planning.
2. Planning documents contain current information on Native American and other traditional users, the status of ethnographic data, the legislative, regulatory, policy, or other bases for uses, and known uses.
3. Design a method of effective consultation with park affiliated communities to comply with law and regulation, to improve working relationships between the park and neighboring cultural communities, and to enhance the park's consideration of traditional resource use.

Stewardship

"Whenever park resources are part of a group's resource base, the Service becomes part of the local cultural system and contributes, however inadvertently, to the group's cultural vitality and the nation's cultural diversity. By maintaining the integrity of these resources, the Service helps maintain the nation's diverse physical, natural, and cultural heritages and acknowledges the human dimension of its stewardship role" (NPS-28, 1993:187).

1. Ensure that traditionally associated groups and neighbors and the legislative, regulatory, or policy bases for relationships with them are identified and known to park staff.
2. Ensure that the Statements for Management address traditionally associated people, Ethnographic resources, and resource uses.

3. Design a system to monitor affects of use on cultural and natural resources and effects of park plans on authorized uses and traditional users.

ISSUES and SYSTEMWIDE ISSUE CATEGORIES

The major issue facing the Ethnographic Resource Program at GRCA is the lack of a program separate from the Archaeological Resource Management Program. The only inventory information that exists for ethnographic resources is that which has been obtained through archaeological studies and consultation of compliance generated projects (C04, C24).

Specifically, there is a lack of baseline data for the park. No database exists, and no information exists which can be used in park planning and management. We have a responsibility to comply with numerous federal laws related to ethnographic resources and traditional cultural properties which is being done in a piece-meal fashion, with no coherent plan. Baseline studies have yet to be completed to assess the ethnographic resources of the park. With 8 separate Indian Tribes which claim ancestry in the canyon, the lack of information hampers any program development (C10, C23).

CURRENT PROGRAM

The current program at Grand Canyon consists of the Park Archaeologist. No staff or funds are allocated to the program. Relationships are maintained with the 8 separate Indian Tribes by the Park Archaeologist. Visits by the Superintendent or Assistant Superintendent do occur but lack of consistency in Park Management positions has made it difficult to meet with tribal leaders this last year.

Funds have been allocated by WASO in FY94

to prepare cultural affiliation studies related to NAGPRA compliance and the Park General Management plan.

Discussions are underway with all of the tribes related to the GMP and park Interpretive plans. In addition, discussions have begun with the Havasupai related to Supai Camp and the Havasupai Traditional Use lands.

The Park Archaeologist serves on the Tri-Regional task-force for implementation of NAGPRA and is currently preparing NAGPRA MOA's with Hopi, Zuni and Hualapai related to repatriation. As a part of the Tri-Regional effort, the Park Archaeologist is also working on a video-taping project for park museum collection materials and will be conducting the consultations related to NAGPRA.

PROPOSED PROGRAM EMPHASIS

Given the enactment of the Native American Graves Protection and Repatriation Act, amendment to the National Historic Preservation Act, and the definition of Traditional Cultural Properties as National Register eligible, the goals for the ethnographic resource management program are focussed on immediate responsibilities and mandates.

GOAL #1: Provide baseline information for NAGPRA and compliance required consultations. As part of our basic legal responsibilities as specified in NPS Management Policies, Grand Canyon will work toward developing in-park training programs which focus on ethnographic resource values, increase sensitivity of park personnel to the diverse cultures of the area, and develop standard guidelines for

conducting compliance related consultations.
(GRCA-C-610.000, GRCA-C-630.001, GRCA-C-630.002, GRCA-C-700.002, GRCA-C-700.003)

GOAL #2: Develop a program to integrate ethnographic resource data into interpretive planning to enhance visitor services and visitor enjoyment throughout the park. (GRCA-C-700.001, GRCA-C-700.002, GRCA-C-700.004, GRCA-710.001)

GOAL #3: Implement baseline inventory, identification, and assessment of ethnographic resources. (GRCA-C-700.001, GRCA-C-700.004, GRCA-710.001. GRCA-C-710.002, GRCA-C-710.003)

GOAL #4: Develop a process by which authorized Native Americans, (and members of other ethnic groups) can obtain access to, and use of, specific NPS managed resources (e.g. "sacred places," natural and cultural resources, curated objects) for traditional cultural practices. (GRCA-C-700.003, GRCA-C-700.004, GRCA-C-630.001)

PROJECT STATEMENT REFERENCE

GRCA-C-700.000	Ethnographic Resource Management Program
GRCA-C-700.001	Prepare Ethnographic Overview and Assessment
GRCA-C-700.002	Prepare Cultural Affiliation Study
GRCA-C-700.003	Develop and Implement Consultation Plan
GRCA-C-700.004	Develop and Implement a Native American Resource Collection and Use Plan
GRCA-C-710.000	INVENTORY AND MONITORING ETHNOGRAPHIC RESOURCES
GRCA-C-710.001	Identification and Management of Traditional Cultural Properties
GRCA-C-710.002	Design and Implement the Ethnographic Resource Inventory database
GRCA-C-710.003	Develop Mitigation Plans for Impacts to Traditional Cultural Properties

Integration of Natural and Cultural Resources Management

INTRODUCTION

In evaluating the highest priority program areas and project statements, and upon an analysis of the most urgent and compelling threats of Grand Canyon's most significant or sensitive resources, it became very clear that some threats endanger more than one type of resource. Often both cultural and natural resources are threatened by the same issue.

Economy and Efficiency: It is very practical to approach resources management from an integrated perspective, for reasons of efficiency and prudent fiscal practices. In *Chapter 2: Present Resource Status*, a discussion about the inaccessibility of the canyon reveals that an interdisciplinary approach to resource management (i.e. inventory, monitoring, research, mitigation measures and maintenance/protection) is very prudent. These tasks and actions can be conducted simultaneously, studying both cultural and natural resources during the same trips into these remote areas.

Integrated Programs: Some programs can offer an interdisciplinary and integrated approach simply by their inherent nature. For example, the Museum Collection protects artifacts and information/data for both cultural and natural resources. A fire or theft at Grand Canyon's Museum Collection would be a tragic and disastrous loss for all management programs. The park fire management program also affects both natural and cultural resources, as discussed in Chapter 2. Oftentimes, a cultural landscape analysis can even reveal both natural and cultural resource values and issues for a certain area.

Springs and seeps in a desert environment have prehistorically and historically been significant to humans, plants, and animals. They are a "museum" of special resources. They provide unique physical resources as well. Where springs occur in caves, the integrated resource value is even more emphasized by the unique nature of caves. Any proposed changes to such areas (e.g. Roaring Springs) should be preceded by a comprehensive and integrated analysis of all resources.

Definition: There is no definition or prescription for the integrated management of resources within the 1988 *National Park Service Management Policies*. At Grand Canyon National Park, this concept is not new, nor is the approach. It is the simple notion that natural and cultural resources often exist together, as part of one or several processes. "Man" is and always has been part of the environment. Threats which endanger a natural resource in one area may also endanger a cultural resource in that same area. A management action to inventory, monitor, research, mitigate or protect one resource, may somehow affect or analyze the other simultaneously.

The staff has been using this approach for years. However, because of the process for funding projects and programs, "integrated project statements" are often overlooked for lack of a funding source. For this reason, those project statement which appear here as "integrated" projects, are also discussed under appropriate cultural and natural resource management program sections in this plan.

They will be listed twice in this manner, to insure that they not be overlooked.

ISSUES

Endangered Riparian Ecosystems and Water Withdrawals: Major watersheds in the park originate far beyond park boundaries. Numerous drainages are contained entirely or largely within the park. These springs hold numerous values to canyon resources due to the uniqueness of water to this arid ecosystem. For centuries, these riparian areas have also been an attraction to humans. Numerous archeological resources as well as present day traditional cultural properties make these areas particularly susceptible to impacts. Water withdrawals outside the park boundaries may alter the unique riparian habitats. Over-visitation and use of these "attractions" threaten their integrity and viability. Exotic plants and animals threaten the unique riparian species. An integrated approach to the study and management of these areas is critical.

Cave Management: Where caves house riparian areas or very unique geological, paleontological, archeological, biological and historical resources, a most delicate balance exists. Spelunkers are not all sensitive to this balance. Vandalism can result in a most tragic loss of resources and information that is yet not discovered by the park. Integrated resources management is a comprehensive way to approach these "gems" in the park.

Fire Management Program: Fire suppression over a period of 70 years has resulted in denser, more uniform plant communities. This has reduced habitat diversity, suppressing many plant and animal populations and contributing to their decline. Fuels have accumulated to the point where fires may rage out of control. Even managed fires can critically damage both natural and cultural resources. An integrated approach to fire

management at Grand Canyon is desperately needed.

Participation in Interagency Cooperative Programs: Partnerships within the Colorado Plateau can protect park resources sometimes more effectively that boundary fence can. Different agency mandates and incompatible land uses at park boundaries have an undetermined effect on the park. *Chapter 2: present Resource Status* discusses some of these impacts. An integrated resource management approach is necessary. A designated park liaison with these agencies; one who understands these integrated resource values, is needed for Grand Canyon. Currently, most adjacent-land communication at Grand Canyon occurs only for reasons of visitor-use management and visitor services; and does not incorporate these other resource concerns.

Impacts in Backcountry Areas and Rehabilitation of Wilderness Impacts: Over-use of wilderness areas pose a significant threat to the park. Over 23,000 visitors float the river annually during a limited season of use. Approximately 12,000 people hike proposed wilderness each year. Nearly 25,000 people camp in the corridor area. Visitors are attracted to many very significant sites within the canyon, some of them containing very sensitive resources. Archeological sites, important riparian areas, and other resources are often negatively impacted. Inadequate trails cause erosion and short-cutting or sometimes the creation of new trail locations. Again, an integrated approach is key in determining the impacts and mitigation measures.

Museum Storage Facility and Data Management: Since the park was established and certainly since even before that time, a steady stream of information, studies, maps, artifacts, archives, photographs, etc., have been accumulating in the park. Some of this

information is contained in the park study collection and others are within the database of the park Geographical Information System (GIS). Together, with the park library, these data systems offer a wealth of clues, secrets, ideas, trials, and studies to offer resource management alternatives.

However, much of this information is unavailable or inaccessible due to a poor storage facility, lack of staff and lack of funding to operate such facilities..

Administrative History and Historic

Resource Studies: A historic study which researches the background and context of certain developments, operations, studies and decisions can reveal very significant information. This information can make a difference in the way in which both natural and cultural resources are managed today. For example, historic properties must be managed on the basis of their significance and integrity. Without factual information about character-defining features during a certain period of significance, important decisions cannot be made. Conjecture is not allowed. For natural resources, a history of issues which threatened the park and an understanding of the way in which the park addressed those issues may lead to very important clues for managing these resources today. These historic studies are often under-rated and are very important in an integrated resource management program.

Cultural Landscape Analysis: In a cultural landscape inventory and analysis, issues of both natural and cultural resources are often addressed. Historic use of vegetation sometimes does not comply with vegetation management practices from a natural resource perspective. Site plans, which deal with structures, circulation, spatial organization, land use, vegetation, etc., are produced during

a cultural landscape study and these plans typically show an integrated approach to addressing natural and cultural resource concerns as well as those for visitor-use management and park operations.

Assistance From Others

An integrated approach to resources management allows a more comprehensive way in which those outside of the division can assist. The dialog with these group can become more meaningful when it is not piecemeal and addresses many issues.

National Biological Service and Northern Arizona University: A more comprehensive research protocol can assist scientists, students and the park. An integrated approach to this relationship would result in better research project emphasis and a deeper understanding of Grand Canyon's condition.

Grand Canyon Trust: The Grand Canyon Trust is dedicated to the conservation of Natural and cultural resources on the Colorado Plateau. They monitor the actions of all public land agencies, including Grand Canyon National Park. They are also committed to assisting Grand Canyon in resource protection. A more integrated resource management approach can help them to understand what issues face the park and how they can assist in mitigation of threats.

Tribal Consultation: The various Native American groups in and around Grand Canyon National Park also have an interest in protecting this sacred canyon. They have expressed that it is their "church" and their place of origin. This is where they lived before Anglo-inhabitation and the creation of a National Park. Some groups are cognizant of any illegal or resource-damaging activities occurring in and around the park where park management cannot get access. These groups

can be the NPS "eyes and ears" in reporting such illegal activities. Especially where sacred sites and Traditional Cultural Properties are affected, tribal liaisons, together with the proposed park ethnographer/park liaison, can help the park develop a much more comprehensive cultural and natural resource protection plan.

Resource Protection Plan: Protection rangers at Grand Canyon patrol the backcountry and river use areas throughout the year. They are charged with protecting park resources in addition to protecting life and property. A formal relationship between this division and resources management can result in better monitoring and protection of park resources in all areas they conduct patrols. An integrated approach will focus their patrols in areas of significance for archeological sites, paleontological resources, wildlife and vegetation inventories and, of course, recreational impacts to all of these resources. Vandalism can perhaps be mitigated with such an approach to backcountry patrols.

Resource Interpretation: One of the best ways to protect resources is to educate the public about the condition and threats to these resources. Allowing interpreters and, thus, the public, an opportunity to understand the connectedness of cultural and natural resources, and hence the role of man in the environment, may result in an increased awareness of how we can all preserve Grand Canyon's resources. For example, spelunkers should be made aware that entering some caves can destroy not only the archeological resources therein, but that the act of entering and using these caves can also negatively impact unique vegetation and wildlife values. Some of these caves are also scared Traditional Cultural Properties. The entire sport of spelunking can be improved to not only better understand, but better protect these unique resources.

Park Maintenance: Park maintenance personnel are also out in various park areas on a daily basis. They usually have a good understanding of visitor-use and resources impacts based on their exposure to park areas at all times of the year. A more comprehensive understanding of park resources can improve this ability to understand the relationship of their activities on park resources. An integrated resources management approach can be incorporated into their programs and priorities annually.

PROGRAM OBJECTIVES

It is critical that resource managers fully understand their role in protecting Grand Canyon's resources. Park resources do not occur in a vacuum, and are interrelated with humans and human activities.

Site visits, inventory and monitoring of resources should be accomplished in an integrated fashion, using an interdisciplinary team of resource specialists and a comprehensive approach.

Assessment of the condition of ecosystems processes should be accomplished in an integrated fashion; understanding the complex relationships and delicate balances between various Natural and cultural resources.

Mitigation, protection and interpretation of these resources and their threats should be based on a comprehensive approach. Groups outside the division of resources management should be fully aware of the connectedness of these resources and their management to better assist resource managers.

CURRENT PROGRAM

Currently, there is an informal relationship between resource managers and integrated resources management is conducted.

Integration of certain programs should be accomplished at a more formal level and during program planning stages.

The Museum Collection is under the Cultural Resources Management Plan, although it is recognized that the collection has both Natural and cultural artifacts and information.

The GIS (Geographical Information System) Program maps both cultural and Natural resources, and manages that information on a more integrated basis.

The rehabilitation of backcountry and wilderness areas impacted by humans is a program which protects both natural and cultural resources.

PROPOSED PROGRAM EMPHASIS

Based on the most pertinent and compelling threats and issues facing Grand Canyon's most significant resources, the following goals are presented in priority order:

GOAL #1: Determine natural vs. anthropogenic impacts and changes to springs, seeps and riparian ecosystem and associated cultural resources and Traditional Cultural Properties.

GRCA-I-100.010 Inventory Spring, Seeps, and Riparian Areas

GRCA-I-140.010 Rehab Known

Wetland/Riparian Areas Impacted by Exotics

GRCA-I-360.201 Evaluate Impacts of Groundwater Withdrawals

GOAL #2: Insure against loss of existing Museum Collection so that there remains baseline information for optimal resource preservation.

GRCA-I-230.022 Museum Storage Facility

GRCA-I-200.002 Provide Base Funding for Museum Collection

GRCA-I-200.001 Provide Curatorial Cyclic Funding

GRCA-I-210.024 Computerization of the Museum Collection

GRCA-I-500.050 Survey and Inventory Collections for Grand Canyon Natural and Cultural Objects

GOAL #3: Inventory and manage caves and all resources therein.

GRCA-I-500.000 Manage Cave Resources

GRCA-I-510.001 Document Cave Resources

GRCA-I-530.101 Revise Cave Management Plan

GRCA-I-570.101 Map and Inventory Caves

GOAL #4: Develop Interagency cooperation to determine external threats and mitigate their affects, in addition to boundary fences.

GRCA-I-240.102 Increase Participation in Interagency Programs

GRCA-I- Boundary Fencing

GOAL #5: Protect both Natural and cultural resources by integrating the survey and management of the park's Prescribed Fire Program.

GRCA-I-161.000 Conduct and Integrate the Prescribed Fire Program

GRCA-I-430.001 Assess Effects of Management Fires on Archeological Resources

GOAL #6: Monitor and mitigate backcountry and wilderness impacts.

GRCA-I-800.001 Backcountry Research and Monitoring

GRCA-I-800.002 Colorado River Use Impact Monitoring

GRCA-I-810.002 Rehabilitation of Wilderness Impacts

GOAL #7: *Protect Cultural Landscapes, and trails when mitigating the biological and sociological effects of over-visitation and use.*

GRCA-I- Prepare CLI on all Park

Developed Areas

GRCA-I- Prepare CLR on all Park

Developed Areas

GRCA-I-310.020 Prepare Administrative
History of Natural Resource Management

GRCA-I-320.003 Prepare HRS on Rim
Roads, Trails and Backcountry

GRCA-I-320.004 Prepare HRS on Trails
Below Canyon Rim

GRCA-I-320.006 Prepare HRS on Mining in
GRCA

GRCA-I-810.001 Stabilization and
Rehabilitation of Historic Trails

GOAL #8: *GIS Program*

Greater Colorado Plateau Cooperative Research Program

INTRODUCTION

The first organized scientific surveys of the Colorado Plateau were initiated shortly after the Civil War. John Wesley Powell and George M. Wheeler lead surveys and published numerous reports on the topography and natural history of the Plateau Region. This region contains outstanding physiographic, climatic, and natural features supporting a diversity of ecological conditions and preserving a remarkable record of human history. Research involving the natural and cultural resources of the Colorado Plateau has provided and will continue to provide extremely valuable information.

A cluster of nearly two dozen National Park Service units on the plateau preserve significant portions of this arid geographic province of plateaus and canyons. Although the parks may bridge administrative and political boundaries, they share important physical characteristics. These include:

- province drained by the Colorado River and its tributaries;
- plateau is uplifted to elevations ranging between 5000 feet (1524 m) to 11000 feet (3353 m);
- climate is arid;
- sparse vegetation coverage;
- extensive areas of nearly horizontal sedimentary formations punctuated by structural upwarps that form spectacular geomorphic features;

Although each park on the plateau represent relict portions of the Greater Colorado Plateau Province, each park unit is typically managed independently and in isolation of the other parks. Park planning affords few funds and little staff time to ventures beyond the park boundaries or internal resource concerns.

Scientists and land managing agency's staff have recently begun to recognize the need to manage at through an "Eco-Regional Approach". The important integration of research and resource management on the Plateau, that was provided previously by the Cooperative Park Studies Unit at Northern Arizona University, is now being administered through the National Biological Survey (NBS) as the Colorado Plateau Research Field Station (CPRS). The CPRS provides a focal point for collecting, sharing, interpreting and disseminating information for Department of Interior Lands on the Colorado Plateau.

Park managers within the Colorado Plateau parks recognize the value of participating in cooperative resource management and research efforts with the other parks and agencies that share this province. Park planning documents, including this Resource Management Plan, are being developed to accommodate this cooperative management perspective.

Grand Canyon National Park's role in developing partnerships with Plateau neighbors includes: coordinate planning and monitoring programs; develop data sharing capabilities; develop MOU's with boundary

sharing tribes; develop external scientific review program; develop NAU research protocol for research liaison with NBS; and evaluate resources with relation to the entire plateau.

PROGRAM OBJECTIVES

The Greater Colorado Plateau Cooperative Research Program at GRCA is developed to support NPS Management Policies beyond the park boundaries. The NPS Natural Resources Management Guidelines (NPS-77, 5:3) indicates that, "NPS research program objectives are centered on providing both descriptive data and an understanding of ecosystem processes, so that managers will be able to make cogent decisions regarding the preservation, maintenance, and appropriate use of NPS natural and cultural resources."

Through this program the Grand Canyon National Park Resources Management Plan recognizes the broader NPS Management Objectives and promotes the parks participation in "Plateau Park" projects. The Long-Term Environmental Monitoring Proposal (LTEM), initiated by the Cooperative Park Studies Unit at Northern Arizona University, exemplifies the type of multi-park research that the Greater Colorado Plateau Cooperative Research Program (GCPCRP) would support.

Specific research objectives are identified in the resource management plan of each park or in regional or Servicewide research program plans and fall under the following broad categories:

- obtaining physical, biological, and ecosystem process information needed for management decision-making;
- complete resource base inventory information on all natural and cultural resources;

- establish appropriate programs for monitoring natural and cultural resources;
- maintaining and managing natural genetic integrity and diversity of park biological resources;
- coordinate research efforts with owners or managers of adjacent lands to ensure the integrity of complete eco- systems.

The Vision Statement within the Grand Canyon National Park Resource Management Plan (GRCA RMP) recognizes the value of cooperative efforts between the Colorado Plateau Parks. The Vision Statement includes the following recommendation:

"Manage the park as part of the greater Colorado Plateau, recognizing the interrelationships between resources management with our park neighbors".

The GRCA RMP identifies 7 specific objectives that support a Greater Colorado Plateau Cooperative Research Program including:

GOAL #1: Manage resources within the ecosystem, transcending political boundaries and jurisdictions;

GOAL #2: Understand, assess and consider the effects of park decisions outside the park, as well as understand the impacts on GRCA resources due to decision making by adjacent land managers;

GOAL #3: Understand, assess and consider the cultures that have historically and are currently living within the Colorado Plateau, with respect to the context for Grand Canyon;

GOAL #4: Work cooperatively to assist local American Indian Tribes in the planning, development and management of tribal lands for recreational use, resource protection and traditional uses;

GOAL #5: Establish formal agreements with adjacent land management agencies to meet resource management and research objectives including: T&E species, air/water quality, fire, climatic change, etc.;

GOAL #6: Continue active role in the Glen Canyon Environmental Studies as a cooperating agency and exercising our custodial role and advocacy for park resources.

GOAL #7: Promote further cooperation with the Colorado Plateau Research Station (CPRS) at Northern Arizona University and establish a GRCA/CPRC liaison position;

These specific objectives support Grand Canyon's role, as part of the Greater Colorado Plateau, through cooperation with all federal, state and local agencies, Native American Groups and private interests in Plateau-wide planning, development and management. The CPRS will serve the pivotal role as the nucleus in integration of interagency endeavors.

ISSUES AND SYSTEMWIDE ISSUE CATEGORIES

The major issue or threat facing Grand Canyon and the other cluster parks of the Colorado Plateau is the need to integrate planning and consistent monitoring protocols (C05, C19, and N20). Additionally, the resource management staff is already overloaded with responsibilities and it would be extremely difficult for current staff levels to coordinate multi-park programs. There is

a serious lack of professional staff in resource management to support Grand Canyon's participation in a Greater Colorado Plateau Research Program (C24 and N24).

Grand Canyon National Park is entirely surrounded by other federal lands managed by a variety of agencies. The different agency mandates and incompatible land uses at park boundaries have an undetermined impact on the park resources (C02, C05, C22, N04, N05, etc.). A list of external threats to Grand Canyon resources was documented in "A Proposal to Perform Integrated, Long-Term Ecological Monitoring Based on Relict Areas Within a Cluster of Nine Colorado Plateau Parks" prepared by Peter G. Rowlands (1993). A highlight of these external threats are listed below:

- threatened & endangered species management and preservation;
- invasion of exotic plants;
- timber harvest along park boundary, on USFS lands;
- potential influence of grazing activities, on adjacent BLM lands, on water quality, wildlife, habitat and sediment processes;
- impact of Glen Canyon Dam on downstream riparian vegetation, native fishes and sediment;
- exotic fish influence on native (endangered) fish;
- feral burros on adjacent BLM and Lake Mead lands;
- uranium mining and mineral extraction on adjacent federal lands;

- impacts of local generating stations and power plants on air quality;
- aircraft overflights and the proposed expansion of Grand Canyon Airport.

CURRENT PROGRAM

Grand Canyon National Park has been associated with some multi-park coordinated monitoring programs in the past. These include aircraft management, air quality and water resources issues. Grand Canyon National Park has cooperated with Glen Canyon NRA and Lake Mead NRA in River Management issues. Other cooperative efforts such as monitoring of threatened and endangered (T&E) species, fire, etc., have been coordinated at the regional office level.

Listed below are some of the multi-park or interagency monitoring programs that Grand Canyon is currently participating:

Air Quality: Research and monitoring focused on evaluating particulate concentrations and visibility.

Aircraft Management: Research directed at acoustical impact evaluation and compliance with flight regulations.

Water Resources: Research and assessment of water quality and quantity issues that threaten both biological and recreational resources.

River and Dam Management: Implementation of the Grand Canyon Colorado River Management Plan in order to assess the visitor impacts on water quality, riparian communities, aquatic communities, sediment deposition, etc.

Glen Canyon Environmental Studies (GCES): Research and long term monitoring of downstream biological, cultural and

physical resources in conjunction with Glen Canyon Dam operations.

Fire Management: Extensive forested areas within and surrounding the park has lead to the establishment of an interagency program for fire management.

Other programs such as Wildlife and Vegetation Management tend to be site specific and managed independently except in cases related to threatened and endangered species (T&E). T&E species monitoring on the plateau has centered around several large multi-park, NRPP efforts involving Peregrine Falcons, Spotted Owls and Bald Eagles.

PROPOSED PROGRAM

Biological Resources

An eco-regional approach to management will greatly enhance the management of biological resources. The program needs to develop consistent methods of monitoring vegetation and wildlife across the plateau to provide credible scientific information. The establishment of consistent monitoring protocols will enable a greater understanding of ecosystem dynamics and the effects of human activities on the ecosystem. At minimum, partnerships need to be established for habitat, T&E species, fire management issues.

Specific Project Statements within the GRCA Resources Management Plan that support an eco-regional approach to biological resources management include:

GRCA-N-010.000 Increase Natural Resources Management staffing

GRCA-I-XXX.XXX Increased participation in cooperative and multi-disciplinary research

projects

GRCA-I-XXX.XXX Participate in regional inventory & monitoring programs

GRCA-I-XXX.XXX Cooperation in interagency fire management and planning; etc.

Geological Resources

This program should oversee the management of the following resources: geologic units, geomorphic features, minerals, mines, soils, caves, paleontological and geothermal resources. Although these are dominant resources in the Colorado Plateau parks, until recently there has been little program guidance for the management of geological resources. Additionally, the NPS employs very few professional geoscientists to assist in geologic resource management. Tremendous potential exists to integrate a geological program across the plateau because of similarities in rock formations, regional tectonic and structural geology, etc.

An eco-regional approach to geological resources is supported by the following GRCA Project Statements:

GRCA-N-010.000 Increases in natural resources management staffing

GRCA-N- Development of paleontologic

GRCA-N- Cave resources management programs

GRCA-I-XXX.000 Participation in interagency inventory & monitoring programs; etc.

Environmental Resources

In the management of environmental resources, including air and water quality, a

regional approach is necessary. The threats imposed by contamination through air or water pollutants can be exhibited over a wide geographic area. Visibility, particulates, gasses and acid deposition monitoring must be conducted at a number of sites to identify air quality trends. The regional approach will facilitate the identification of types, patterns and sources of air pollutants. Similarly, a cooperative effort in managing water resources will provide the most efficient and regionally beneficial method.

The Project Statements that support an Eco-regional approach to management of environmental resources include:

GRCA-I-XXX.XXX Cooperation in regional planning for air quality

GRCA-N-XXX.XXX Monitoring of natural systems effected by water quality deterioration; etc.

Cultural Resources

The cultural resources preserved at Grand Canyon National Park contribute significant information regarding the human history on the Colorado Plateau. A cooperative approach towards historical, archeological and ethnographic resources on the plateau will increase the understanding of the cultural development in the changing ecosystem. The regional perspective of cultural resources will integrate a larger database and permit wider opportunities for inquiry and analysis. The proposed program for cultural resources should establish partnerships with other Colorado Plateau parks and neighbors to support an Eco-Regional approach.

The priority Project Statements which support a eco-regional approach to management of cultural resources include:

GRCA-C-110.000 Increases in CRM staffing

GRCA-C-120.000/120.002 Establish interagency, university and tribal cooperative agreements and MOU's

GRCA-I-XXX.XXX Participate in regional inventory & monitoring programs for cultural resources

GRCA-I-XXX.XXX Participate in the development of interagency resource database development; etc.

PROJECT STATEMENT REFERENCE

GRCA-C-110.000	Increase Cultural Resource Management Staff
GRCA-C-110.001	Establish Park Ethnographer
GRCA-C-110.002	Establish Park Historian
GRCA-C-120.000	Establish Interagency, University and Tribal Cooperative Agreements
GRCA-C-120.001	Establish Liaison Position with local Universities
GRCA-C-120.002	Establish MOU's with Adjacent Tribes for Co-Management of Natural Resources
GRCA-C-130.000	Maintain government to government relationships with Indian Tribes
GRCA-C-300.000	Historic Resources Management Program
GRCA-C-300.009	Data Management for Historic Resources
GRCA-C-320.000	Complete Historic Resources Studies
GRCA-C-330.000	Cultural Landscape Management Program
GRCA-C-400.000	Archeological Resources Management Program
GRCA-C-400.002	Implement Systemwide Archeological Inventory Program (SAIP)
GRCA-C-440.000	Maintenance of Archeological Database
GRCA-C-500.000	Cultural Resources Information Management Program
GRCA-C-700.000	Ethnographic Resource Management Program
GRCA-I-161.000	Conduct & Integrate Prescribed Fire Program
GRCA-I-240.102	Increased Participation in Interagency Cooperative Programs
GRCA-I-500.000	Manage Cave Resources
GRCA-N-010.000	Increase Natural Resources Management Staff
GRCA-N-110.000	Develop Multidisciplinary Studies to Determine Past Climate Change
GRCA-N-111.000	Research Grassland Changes due to Historic Grazing
GRCA-N-112.000	Inventory & Manage Forest Insects & Disease
GRCA-N-140.000	Develop Exotic Plant Management Program
GRCA-N-200.101	Inventory all Threatened, Endangered, and Sensitive Species
GRCA-N-200.201	Implement Monitoring Program for all Threatened, Endangered, and Sensitive Species
GRCA-N-240.102	Increased Participation in Interagency Cooperative Programs
GRCA-N-300.000	Manage Water Resources to Restore, Preserve and Protect Natural Systems
GRCA-N-400.000	Manage Paleontological Resources for their Preservation
GRCA-N-500.000	Manage Cave Resources for their Preservation
GRCA-N-710.000	Provide Overall Planning for Protection of Air Resources
GRCA-N-770.401	Participate in Regional Air Quality Management Efforts
GRCA-N-900.102	Develop Geographical Information Networking/Data Sharing Capabilities

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TABLE 1
NPS RESOURCE PERSONNEL
(current year only)

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TYPE OF NPS EMPLOYEE	FTEs OF RESOURCES WORK		
	Natural	Cultural	Total
Research Scientists	0.0	0.0	0.0
Resources Specialists	8.6	7.0	15.6
025 Park Rangers Res Mgmt	0.0	0.0	0.0
025 Park Rangers Res Prot	0.0	0.0	0.0
025 Park Rangers Res Interp	0.5	0.5	1.0
Maintenance Personnel	0.8	0.0	0.8
Total of RES Personnel	9.9	7.5	17.4
TOTAL PARK FTE: 317.0 PERCENT	3.1%	2.4%	5.5%

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TABLE 2
NATURAL AND CULTURAL
CURRENT YEAR FUNDING
(\$ in thousands - by activity type)

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REGION: WRO

FUNDING SOURCE	TOTAL	RES	MIT	MON	PRO	INT	ADM
PCR2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCRP	392.00	92.00	0.00	0.00	300.00	0.00	0.00
SFIR	144.80	0.00	121.80	23.00	0.00	0.00	0.00
PNR1	734.00	16.00	184.00	534.00	0.00	0.00	0.00
RCCM	54.00	0.00	0.00	0.00	54.00	0.00	0.00
NPRF	5.00	0.00	0.00	0.00	0.00	0.00	5.00
SNAQ	43.00	0.00	0.00	43.00	0.00	0.00	0.00
NFED	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTH	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PNR2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	1372.80	108.00	305.80	600.00	354.00	0.00	5.00

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PROGRAMMING SHEET 1
NATURAL
CURRENT YEAR FUNDED ACTIVITIES
(\$ in thousands)

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OBJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM- WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994		OUTYEAR 1 1995		OUTYEAR 2 1996		OUTYEAR 3 1997		TOTAL
							\$\$	FTE	\$\$	FTE	\$\$	FTE	\$\$	FTE	\$\$
0.00	INCREASE NATURAL RESOURCE MANAGEMENT STAFFING				N24	PKBASE-NR MON	412.00	8.9	412.00	8.9	412.00	8.9	412.00	8.9	1648.00
						? MIT	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
						AIR-QUAL MON	18.00	1.0	18.00	1.0	18.00	1.0	18.00	1.0	72.00
						Subtotal	430.00	9.9	430.00	9.9	430.00	9.9	430.00	9.9	1720.00
2.000	INVENTORY & MANAGE FOREST INSECTS & DISEASES				N04 N20	PKBASE-NR MON	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.00
20.000	EXPAND FIRE EFFECTS MONITORING PROGRAM				N07	FIRE-\$ MON	23.00	1.5	0.0	0.0	0.0	0.0	0.0	0.0	23.00
30.000	SURVEYS AND REPORTS FOR SPECIAL STATUS PLANTS				N20 N03	PKBASE-NR MON	2.50	0.2	2.50	0.2	2.50	0.2	2.50	0.2	10.00
30.020	CONDUCT SITE-SPECIFIC PROJECT COMPLIANCE SURVEYS				N03	PKBASE-NR MON	2.50	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.50
						FIRE-\$ MON	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
						Subtotal	2.50	0.5	0.00	0.0	0.00	0.0	0.00	0.0	2.50
130.030	MANAGEMENT OF SENTRY MILK-VETCH				N03 N20	PKBASE-NR MON	1.00	2.0	1.00	2.0	1.00	2.0	1.00	2.0	4.00
						Project Total	6.00	2.7	3.50	2.2	3.50	2.2	3.50	2.2	16.50
150.000	CONTINUE AND UPDATE HAZARD TREE MANAGEMENT PROGRAM				N24	PKBASE-NR MON	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.00
						PKBASE-NR MIT	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
						Subtotal	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.00
180.000	DEVELOP NATIVE PLANT PROPAGATION PROGRAM				N06 N22	PKBASE-NR MIT	7.00	0.3	7.00	0.3	7.00	0.3	7.00	0.3	28.00
200.101	INVENTORY ALL THREATENED, ENDANGERED &				N02	PKBASE-NR RES	10.00	0.2	10.00	0.2	10.00	0.2	10.00	0.2	40.00

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PROGRAMMING SHEET 1
NATURAL
CURRENT YEAR FUNDED ACTIVITIES
(\$ in thousands)

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PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM- WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 \$\$ FTE		OUTYEAR 1 1995 \$\$ FTE		OUTYEAR 2 1996 \$\$ FTE		OUTYEAR 3 1997 \$\$ FTE		T
	SENS. SPEC.														
200.104	INVENTORY & ASSESS SOUTHWEST WILLOW FLYCATCHER			N02 N04	?	RES	62.00	0.5	62.00	0.5	0.0	0.0	0.0	0.0	124
200.204	MONITOR PEREGRINE FALCON POPULATION			N02		PKBASE-NR MON	1.00	0.0	1.00	0.0	1.00	0.0	1.00	0.0	4.
200.205	MANAGE THE HUMPBACK CHUB POPULATION			N02		FED-OTHER RES	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
Project Total							73.00	0.7	73.00	0.7	11.00	0.2	11.00	0.2	168
201.110	CONDUCT INVENTORY & ASSESSMENT: CORRIDOR BIRDS			N02 N04	?	RES	141.00	0.5	144.00	0.5	0.0	0.0	0.0	0.0	285
210.101	MANAGE IPM PROGRAM			N04 N05		PKBASE-NR MIT	8.00	0.2	8.00	0.2	8.00	0.2	8.00	0.2	3
210.105	MANAGE HABITUATED/BEGGA R WILDLIFE			N16		PKBASE-NR MIT	5.00	0.1	2.00	0.0	2.00	0.0	2.00	0.0	1
Project Total							13.00	0.3	10.00	0.2	10.00	0.2	10.00	0.2	4
230.102	MANAGE FERAL BURRO POPULATION			N04		PKBASE-NR MIT	2.00	0.0	2.00	0.0	2.00	0.0	2.00	0.0	
240.104	IMPACTS TO WILDLIFE FROM ADJ. LAND TIMBER HARVEST			N19		PKBASE-NR MIT	26.00	0.5	26.00	0.5	26.00	0.5	26.00	0.5	1
242.101	PERFORM CYCLIC BOUNDARY FENCE MAINTENANCE			N19		PKBASE-NR MIT	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	1

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CURRENT YEAR FUNDED ACTIVITIES
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PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM- WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 \$ FTE		OUTYEAR 1 1995 \$ FTE		OUTYEAR 2 1996 \$ FTE		OUTYEAR 3 1997 \$ FTE		TOTAL \$
90.101	SUPPORT NPS WATER RIGHTS CLAIMS FOR LITTLE COL. RIV				N13 N12 PKBASE-NR MON		6.00	0.2	6.00	0.2	6.00	0.2	0.0	0.0	18.00
20.101	MONITOR VISIBILITY				N14 AIR-QUAL MON		25.00	0.4	25.00	0.4	25.00	0.4	25.00	0.4	100.00
50.501	MONITOR BIOLOGICAL EFFECTS OF AIR POLLUTION				N14 N20 PKBASE-NR MON		2.00	0.1	2.00	0.1	2.00	0.1	2.00	0.1	8.00
800.003	DEVELOP TRAVEL SIMULATION MODEL FOR COLORADO RIVER				N18 N20 PKBASE-NR MON		1.00	0.1	1.00	0.1	1.00	0.1	1.00	0.1	4.00
					PKBASE-NR MIT		0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
					Subtotal		1.00	0.1	1.00	0.1	1.00	0.1	1.00	0.1	4.00
810.002	REHABILITATION OF WILDERNESS RESOURCE IMPACTS				N18 N06 PKBASE-NR MIT		15.00	0.1	15.00	0.1	15.00	0.1	15.00	0.1	60.00
					NON-NPS-O MIT		0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
					Subtotal		15.00	0.1	15.00	0.1	15.00	0.1	15.00	0.1	60.00
810.003	DEVELOP WILDERNESS WASTE MANAGEMENT PROGRAM				N18 PKBASE-NR MIT		0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
810.004	STUDY & MITIGATE STOCK USE IMPACTS				N18 PKBASE-NR MIT		80.00	6.0	80.00	6.0	80.00	6.0	80.00	6.0	320.00
					PKBASE-NR MON		0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
					Subtotal		80.00	6.0	80.00	6.0	80.00	6.0	80.00	6.0	320.00
810.005	MITIGATE ROAD IMPACTS TO THE BASIN MEADOW				N06 TEMP\$-NR MIT		0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
					PKBASE-NR MON		0.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
					Subtotal		0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
810.006	MANAGE AIRCRAFT OVERFLIGHTS				N15 PKBASE-NR MON		19.00	0.5	19.00	0.5	19.00	0.5	19.00	0.5	76.00
Project Total							114.00	6.6	114.00	6.6	114.00	6.6	114.00	6.6	456.00

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NATURAL
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(\$ in thousands)

PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM- WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 \$\$ FTE		OUTYEAR 1 1995 \$\$ FTE		OUTYEAR 2 1996 \$\$ FTE		OUTYEAR 3 1997 \$\$ FTE		
820.001	UPDATE BACKCOUNTRY MANAGEMENT PLAN				N18 N20	PKBASE-NR RES	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.0
						PKBASE-NR INT	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
						PKBASE-NR MON	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
						PKBASE-NR PRO	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
						Subtotal	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.0
820.002	REVISE COLORADO RIVER MANAGEMENT PLAN				N18 N20	PKBASE-NR RES	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.0
						PKBASE-NR INT	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
						PKBASE-NR MON	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
						PKBASE-NR PRO	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
						Subtotal	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.0
						Project Total	6.00	0.2	6.00	0.2	6.00	0.2	6.00	0.2	24.0
830.001	UPDATE NEPA COMPLIANCE FOR WILDERNESS RECOMMENDATIO				N24	TEMP\$-NR ADM	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
830.002	CONDUCT WILD & SCENIC RIVERS SUITABILITY STUDY				N12 N18	PKBASE-NR MON	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.0
						Project Total	3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.0
900.102	DEVELOP GIS NETWORKING/DATA SHARING CAPABILITIES				N20	PKBASE-NR MIT	3.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32 projects printed						Grand Total	890.00	24.4	861.50	22.3	655.50	21.3	649.50	21.1	30.0

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PROGRAMMING SHEET 2
NATURAL
UNFUNDED ACTIVITIES
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PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM- WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR		OUTYEAR 1		OUTYEAR 2		OUTYEAR 3		TOTAL
							\$\$	FTE	\$\$	FTE	\$\$	FTE	\$\$	FTE	\$\$
900.103	DEVELOP WILDLIFE-HAB ITAT RELATIONAL DATABASE				N20 N24 NON-PROFI	MON	15.00	0.5	0.0	0.0	0.0	0.0	0.0	0.0	15.00
200.102	DISTRIBUTION & RISK STATUS OF KANAB AMBERSNAIL				N02	?	RES	20.00	0.0	11.00	0.0	0.0	0.0	0.0	31.00
220.001	FEASIBILITY OF RIVER OTTER REINTRODUCTI ON				N02 N20 RG-NS-RES	RES	25.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.00
200.103	CONDUCT SURVEY OF SPOTTED OWL POPULATION				N02	RG-NS-RES	RES	20.00	1.0	0.0	0.0	0.0	0.0	0.0	20.00
200.202	MONITOR COWBIRDS AT CORRALS & STOCK AREAS				N02 N04 PKBASE-NR	MON	5.00	0.2	5.00	0.2	0.0	0.0	0.0	0.0	10.00
200.203	MONITOR WILLOW FLYCATCHERS ALONG COLORADO RIVER				N02 N04 TEMP\$-NR	MON	35.00	1.0	35.00	1.0	0.0	0.0	0.0	0.0	70.00
200.204	MONITOR PEREGRINE FALCON POPULATION				N02	PKBASE-NR	MON	5.00	0.0	5.00	0.0	5.00	0.0	5.00	20.00
200.303	DETERMINE WILLOW FLYCATCHER POPULATION DYNAMICS				N02 N04 \$-DONATE	RES	20.00	0.0	20.00	0.0	0.0	0.0	0.0	0.0	40.00

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(\$ in thousands)

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K RI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM- WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR		OUTYEAR 1		OUTYEAR 2		OUTYEAR 3		TOTAL
								\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$
	201.113	AN HERPETOFAUNA L INVENTORY OF GRAND CANYON				N20	RG-NS-RES RES	35.00	0.0	35.00	0.0	40.00	0.0	0.0	0.0	110.00
	201.201	MONITOR NATIVE FISH COMMUNITY IN THE COLORADO RIVER				N02	FED-OTHER RES	40.00	0.0	40.00	0.0	40.00	0.0	0.0	0.0	120.00
							RG-NS-RES RES	0.0	0.0	0.0	0.0	0.0	0.0	40.00	0.0	40.00
							Subtotal	40.00	0.0	40.00	0.0	40.00	0.0	40.00	0.0	160.00
							Project Total	75.00	0.0	75.00	0.0	80.00	0.0	40.00	0.0	270.00
	230.103	MONITOR NON-NATIVE FISHES, MITIGATE IMPACTS				N02 N04	RG-NS-RES RES	150.00	0.0	150.00	0.0	150.00	0.0	0.0	0.0	450.00
	230.102	MANAGE FERAL BURRO POPULATION				N04	PKBASE-OT MON	5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.00
							Project Total	155.00	0.0	150.00	0.0	150.00	0.0	0.00	0.0	455.00
	210.101	MANAGE IPM PROGRAM				N04 N05	RG-RM-NAT MIT	26.00	1.0	26.00	1.0	26.00	1.0	26.00	1.0	104.00
	900.102	DEVELOP GIS NETWORKING/D ATA SHARING CAPABILITIES				N20	PKBASE-OT MIT	10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.00
	201.106	INVENTORY, MONITOR & ASSESS INVERTEBRATE S				N20	RG-NS-RES RES	30.00	0.0	30.00	0.0	30.00	0.0	30.00	0.0	120.00
	201.107	INVENTORY TERRESTRIAL INVERTEBRATE S				N20	RG-NS-RES RES	40.00	0.0	40.00	0.0	40.00	0.0	0.0	0.0	120.00

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PROGRAMMING SHEET 2

NATURAL

UNFUNDED ACTIVITIES

(\$ in thousands)

PK	PROJECT	PROJECT TITL	PKG	CULT	SYSTEM-	FUNDING	ACT	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	
PRI	NUMBER		NUM	RES	WIDE	SOURCE	TYP					
				TYPE	ISSUE			\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	
<hr/>												
						Project Total		70.00 0.0	70.00 0.0	70.00 0.0	30.00 0.0	24
0	300.101	UPDATE WATER RESOURCES MANAGEMENT PLAN		N12	N13	WATER-RES ADM		35.00 0.7	0.0 0.0	0.0 0.0	0.0 0.0	3
0	310.501	DESIGN A WATER RESOURCES MONITORING PROGRAM		N12	N11	WATER-RES MON		11.00 0.3	0.0 0.0	0.0 0.0	0.0 0.0	
0	310.502	LONG-TERM MONITORING OF WATER QUALITY & QUANTITY		N12	N11	WATER-RES MON		30.00 0.5	30.00 0.5	30.00 0.5	30.00 0.5	1
<hr/>												
						Project Total		41.00 0.8	30.00 0.5	30.00 0.5	30.00 0.5	1
0	330.201	FLOOD CONTINGENCY PLAN FOR CORRIDOR DEVELOPMENTS		N18	N22	TEMP\$-OTH PRO		10.00 0.4	0.0 0.0	0.0 0.0	0.0 0.0	
0	330.401	MONITOR BACTERIA OF COLORADO RIVER & TRIBUTARIES		N11	N18	WATER-RES MON		25.00 0.8	15.00 0.8	0.0 0.0	0.0 0.0	
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						Project Total		35.00 1.2	15.00 0.8	0.00 0.0	0.00 0.0	
0	350.201	DELINEATE WETLANDS IN AREAS OF DEVELOPMENT		N06	N20	WATER-RES RES		5.00 0.1	0.0 0.0	0.0 0.0	0.0 0.0	

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K	PROJECT	PROJECT TITL	PKG	CULT	SYSTEM-	FUNDING	ACT	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	TOTAL	
RI	NUMBER		NUM	RES	WIDE	SOURCE	TYP						
				TYPE	ISSUE			\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$	
	360.101	IDENTIFY ALTERNATIVE SOURCES OF POTABLE WATER		N12		WATER-RES RES		50.00 0.2	300.00 0.8	0.0 0.0	0.0 0.0	350.00	
	360.102	DEVELOP EIS INFORMATION FOR ALTERNATIVE WATER SUPP.		N12	N24	WATER-RES RES		25.00 0.0	0.0 0.0	0.0 0.0	0.0 0.0	25.00	
	360.202	DEVELOP INFORMATION FOR TUSAYAN WATER SALES E.A.		N12		WATER-RES PRO		10.00 0.4	0.0 0.0	0.0 0.0	0.0 0.0	10.00	
	360.501	ASSESS IMPACTS OF DIVERSIONS FROM ROARING SPRINGS		N12		WATER-RES RES		18.00 0.6	8.00 0.4	0.0 0.0	0.0 0.0	26.00	
	360.901	INTERPRET WATER SUPPLY AND CONSERVATION		N12		NON-PROFI INT		2.00 0.1	0.0 0.0	0.0 0.0	0.0 0.0	2.00	
								Project Total	105.00 1.3	308.00 1.2	0.00 0.0	0.00 0.0	413.00
	640.101	EVALUATE GEOLOGIC HAZARDS		N10	N20	ENER-MIN RES		20.00 0.0	0.0 0.0	0.0 0.0	0.0 0.0	20.00	
						ENER-MIN MON		0.0 0.0	2.00 0.0	2.00 0.0	2.00 0.0	6.00	
								Subtotal	20.00 0.0	2.00 0.0	2.00 0.0	26.00	
	640.401	MANAGE AND RECLAIM ABANDONED MINERAL LANDS		N10		ENER-MIN MIT		40.00 0.3	40.00 0.3	40.00 0.3	20.00 0.1	140.00	
								Project Total	60.00 0.3	42.00 0.3	42.00 0.3	22.00 0.1	166.00

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NATURAL

UNFUNDED ACTIVITIES

(\$ in thousands)

PK	PROJECT	PROJECT TITL	PKG	CULT	SYSTEM-	FUNDING	ACT	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	
PRI	NUMBER		NUM	RES	WIDE	SOURCE	TYP					
				TYPE	ISSUE			\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	
0	710.001	DEVELOP AIR QUALITY MANAGEMENT PLAN		N14		AIR-QUAL	ADM	50.00 0.8	0.0 0.0	0.0 0.0	0.0 0.0	50
0	750.501	MONITOR BIOLOGICAL EFFECTS OF AIR POLLUTION		N14	N20	AIR-QUAL	MON	26.00 0.5	26.00 0.5	26.00 0.5	26.00 0.5	10
0	720.601	IDENTIFY AIR QUALITY REALTED VALUES		N14		AIR-QUAL	PRO	5.00 0.2	1.00 0.1	1.00 0.1	1.00 0.1	
0	730.101	INVENTORY IN-PARK AIR POLLUTION SOURCES & COMPLIANC		N14	N20	AIR-QUAL	RES	50.00 0.5	0.0 0.0	0.0 0.0	0.0 0.0	5
						PKBASE-NR	MIT	0.0 0.0	5.00 0.1	5.00 0.1	5.00 0.1	1
						Subtotal		50.00 0.5	5.00 0.1	5.00 0.1	5.00 0.1	6
0	770.401	PARTICIPATE IN REGIONAL AIR QUALITY MANAGEMENT		N14	N20	AIR-QUAL	MIT	40.00 1.0	40.00 1.0	40.00 1.0	40.00 1.0	16
0	220.002	BIOLOGY & REINTRODUCTI ON OF BONYTAIL CHUB LITERATURE REVIEW		N02		RG-NS-RES	RES	30.00 0.5	0.0 0.0	0.0 0.0	0.0 0.0	3
0	242.101	PERFORM CYCLIC BOUNDARY FENCE MAINTENANCE		N19		PKBASE-OT	MIT	10.00 0.4	10.00 0.4	10.00 0.4	10.00 0.4	4
0	201.301	DEVELOP ENERGY FLOW AND MATERIAL CYCLING MODELS		N20		RG-NS-RES	RES	130.00 0.0	130.00 0.0	130.00 0.0	0.0 0.0	39

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PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES	SYSTEM- WIDE TYPE	FUNDING SOURCE	ACT TYPE	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	TOTAL
							\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$
900.105	IMPLEMENTATA TION OF INTEGRATED DATA MANAGEMENT		N24		PKBASE-OT MIT		80.00 1.0	10.00 0.0	10.00 0.0	0.0 0.0	100.00
200.106	MONITOR AND MITIGATE T&E SPECIES: RAZORBACK SUCKER		N02		FED-OTHER MON		50.00 0.5	35.00 0.5	35.00 0.5	35.00 0.5	155.00
200.306	DETERMINE NEED TO CLOSE HABITAT OF KANAB AMBERSNAIL		N02		RG-NS-RES RES		6.00 0.2	0.0 0.0	0.0 0.0	0.0 0.0	6.00
							=====				
Project Total							56.00 0.7	35.00 0.5	35.00 0.5	35.00 0.5	161.00
201.112	INVENTORY SPRING, SEEP, & WETLAND INVERTEBRATE S		N20		RG-NS-RES RES		60.00 0.0	50.00 0.0	22.00 0.0	0.0 0.0	132.00
220.003	BIOLOGY & REINTRODUCTI ON OF COLO. RIVER SQUAWFISH LITERATURE REVIEW		N02		FED-OTHER MON		30.00 0.5	0.0 0.0	0.0 0.0	0.0 0.0	30.00
201.203	MONITOR KAIBAB SQUIRREL POPULATION TRENDS		N20		PKBASE-OT MON		6.00 0.2	0.0 0.0	6.00 0.2	0.0 0.0	12.00

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PK	PROJECT	PROJECT TITL	PKG	CULT	SYSTEM-	FUNDING	ACT	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	
PRI	NUMBER		NUM	RES	WIDE	SOURCE	TYP					
				TYPE	ISSUE			\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	
0	900.107	DEVELOP & UPDATE BIOLOGICAL TAXON CHECKLISTS		N20		PKBASE-NR	MIT	1.00 0.0	0.0 0.0	0.0 0.0	0.0 0.0	
0	250.101	ASSESS IMPACTS OF URBANIZATION ON WILDLIFE		N20		RG-NS-RES	RES	10.00 0.0	0.0 0.0	0.0 0.0	0.0 0.0	1
0	240.101	RESEARCH AIRCRAFT IMPACTS ON WILDLIFE		N15		FED-OTHER	RES	55.00 0.0	55.00 0.0	55.00 0.0	0.0 0.0	16
0	200.307	GENETICS & AUTECOLOGY OF KANAB AMBERSNAIL		N02 N20		FED-OTHER	RES	24.00 0.0	22.00 0.0	0.0 0.0	0.0 0.0	4
0	140.000	DEVELOP EXOTIC PLANT MANAGEMENT PROGRAM		N05		PKBASE-NR	MIT	240.00 5.0	240.00 5.0	240.00 5.0	240.00 5.0	96
0	150.000	CONTINUE AND UPDATE HAZARD TREE MANAGEMENT PROGRAM		N24		TEMP\$-NR	MON	30.00 2.5	30.00 2.5	30.00 2.5	0.0 0.0	5
						TEMP\$-NR	MIT	0.00 0.0	0.00 0.0	0.00 0.0	0.0 0.0	
						PKBASE-NR	MON	0.0 0.0	0.0 0.0	0.0 0.0	30.00 2.5	3
						PKBASE-NR	MIT	0.0 0.0	0.0 0.0	0.0 0.0	0.00 0.0	
						Subtotal		30.00 2.5	30.00 2.5	30.00 2.5	30.00 2.5	12
0	100.030	CONDUCT MONITORING ON ALTERED LANDSCAPES PARKWIDE		N20		TEMP\$-NR	MON	100.00 0.0	100.00 0.0	100.00 0.0	0.0 0.0	30
						PKBASE-NR	MON	0.0 0.0	0.0 0.0	0.0 0.0	50.00 1.9	5
						Subtotal		100.00 0.0	100.00 0.0	100.00 0.0	50.00 1.9	35
0	100.000	DEVELOP COMPREHENSIV E VEG. MONITORING PROGRAM		N20		TEMP\$-NR	MON	150.00 0.0	150.00 0.0	150.00 0.0	0.0 0.0	4
						PKBASE-NR	MON	0.0 0.0	0.0 0.0	0.0 0.0	50.00 3.9	5
						Subtotal		150.00 0.0	150.00 0.0	150.00 0.0	50.00 3.9	5

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PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES	SYSTEM- WIDE TYPE	FUNDING SOURCE	ACT TYP	STARTING YEAR		OUTYEAR 1		OUTYEAR 2		OUTYEAR 3		TOTAL
							\$	FTE	\$	FTE	\$	FTE	\$	FTE	\$
110.000	DEVELOP MUTIDISC. STUDIES TO DETERMINE PAST CLIMATE		N20	N17	TEMP\$-NR PKBASE-NR	MON	100.00	0.0	100.00	0.0	100.00	0.0	0.0	0.0	300.00
							0.0	0.0	0.0	0.0	0.0	0.0	30.00	0.6	30.00
					Subtotal		100.00	0.0	100.00	0.0	100.00	0.0	30.00	0.6	330.00
170.000	MANAGE AND RESTORE ALTERED RIPARIAN SYSTEMS		N06	N12	PKBASE-NR	MIT	80.00	5.0	80.00	5.0	80.00	5.0	80.00	5.0	320.00
160.010	DEVELOP SITE REHABILITATI ON PLAN		N22		TEMP\$-NR TEMP\$-NR	MON MIT	8.00 0.00	0.3 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	8.00 0.00
					Subtotal		8.00	0.3	0.00	0.0	0.00	0.0	0.00	0.0	8.00
180.010	EVALUATE EFFECTIVENES S OF REVEG PROTOCOL & PROGRAMS		N06	N22	PKBASE-NR	MON	8.00	0.5	8.00	0.5	8.00	0.5	8.00	0.5	32.00
130.000	SURVEYS AND REPORTS FOR SPECIAL STATUS PLANTS		N20	N03	TEMP\$-NR	MON	52.50	0.0	52.50	0.0	52.50	0.0	52.50	0.0	210.00
172.000	ESTABLISH VEGETATION MANAGEMENT CREW		N06	N22	PKBASE-NR	MIT	344.00	11.0	344.00	11.0	344.00	11.0	344.00	11.0	1376.00
120.000	EXPAND FIRE EFFECTS MONITORING PROGRAM		N07		PKBASE-NR	MON	10.00	1.0	30.00	2.5	30.00	2.5	30.00	2.5	100.00
121.000	EXPAND FIRE HISTORY STUDIES		N07		TEMP\$-NR FIRE-\$	RES RES	30.00 0.00	1.0 0.0	30.00 0.0	1.0 0.0	20.00 0.0	1.0 0.0	0.0 0.0	0.0 0.0	80.00 0.00
					Subtotal		30.00	1.0	30.00	1.0	20.00	1.0	0.00	0.0	80.00

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PK	PROJECT	PROJECT TITL	PKG	CULT	SYSTEM-	FUNDING	ACT	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	
PRI	NUMBER		NUM	RES	WIDE	SOURCE	TYP					
				TYPE	ISSUE			\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$ FTE	
0	111.000	RESEARCH GRASSLAND CHANGES DUE TO HISTORIC GRAZING		N19		TEMP\$-NR	MON	30.00 0.5	30.00 0.5	30.00 0.5	0.0 0.0	90.0
0	112.000	INVENTORY & MANAGE FOREST INSECTS & DISEASES		N04 N20		PKBASE-NR	MON	10.00 0.4	10.00 0.4	10.00 0.4	10.00 0.4	40.0
0	180.000	DEVELOP NATIVE PLANT PROPAGATION PROGRAM		N06 N22		PKBASE-NR	MIT	150.00 3.0	150.00 3.0	150.00 3.0	150.00 3.0	600.0
0	130.010	DEVELOP PROTOCOLS FOR MONITORING PARK ECOSYSTEMS		N20		PKBASE-NR	MON	41.00 1.0	170.00 6.0	170.00 6.0	170.00 6.0	551.0
0	171.000	REHABILITATE IMPACTED AREAS IN DEVELOPED ZONES		N06 N22		PKBASE-NR	MIT	100.00 5.0	100.00 5.0	100.00 5.0	100.00 5.0	400.0
0	100.020	CONDUCT PARKWIDE RELICT AREA SURVEY		N20		TEMP\$-NR	MON	100.00 0.0	100.00 0.0	100.00 0.0	0.0 0.0	300.0
						PKBASE-NR	MON	0.0 0.0	0.0 0.0	0.0 0.0	40.00 1.0	40.0
						Subtotal		100.00 0.0	100.00 0.0	100.00 0.0	40.00 1.0	340.0
0	130.020	CONDUCT SITE-SPECIFI C PROJECT COMPLIANCE SURVEYS		N03		PKBASE-NR	MON	10.50 1.0	10.50 1.0	10.50 1.0	10.50 1.0	42.0
0	160.000	DEVELOP A VEGETATION MANAGEMENT PLAN PARKWIDE		N22 N08		TEMP\$-NR	MON	10.00 0.5	0.0 0.0	0.0 0.0	0.0 0.0	10.0
						TEMP\$-NR	MIT	0.00 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0
						Subtotal		10.00 0.5	0.00 0.0	0.00 0.0	0.00 0.0	10.0

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PROJECT NUMBER	PROJECT TITLE	FMS NUM	CULT RES TYPE	SYSTEM WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	TOTAL
							\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$
800.005	RESEARCH & MONITOR NATURAL QUIET				N15	TEMP\$-NR MON	28.00 0.5	0.0 0.0	0.0 0.0	0.0 0.0	28.00
						PKBASE-NR MON	0.0 0.0	8.00 0.5	8.00 0.5	8.00 0.5	24.00
						Subtotal	28.00 0.5	8.00 0.5	8.00 0.5	8.00 0.5	52.00
800.003	DEVELOP TRAVEL SIMULATION MODEL FOR COLORADO RIVER				N18 N20	PKBASE-NR MON	20.00 0.5	8.00 0.3	8.00 0.3	8.00 0.3	44.00
						PKBASE-NR MIT	0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0.00
						Subtotal	20.00 0.5	8.00 0.3	8.00 0.3	8.00 0.3	44.00
Project Total							48.00 1.0	16.00 0.8	16.00 0.8	16.00 0.8	96.00
810.003	DEVELOP WILDERNESS WASTE MANAGEMENT PROGRAM				N18	PKBASE-NR MIT	50.00 1.0	50.00 1.0	50.00 1.0	50.00 1.0	200.00
810.004	STUDY & MITIGATE STOCK USE IMPACTS				N18	PKBASE-NR MIT	110.00 6.0	110.00 6.0	110.00 6.0	110.00 6.0	440.00
						PKBASE-NR MON	0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0.00
						Subtotal	110.00 6.0	110.00 6.0	110.00 6.0	110.00 6.0	440.00
810.005	MITIGATE ROAD IMPACTS TO THE BASIN MEADOW				N06	TEMP\$-NR MIT	80.00 1.0	0.0 0.0	0.0 0.0	0.0 0.0	80.00
						PKBASE-NR MON	0.0 0.0	1.00 0.1	1.00 0.1	1.00 0.1	3.00
						Subtotal	80.00 1.0	1.00 0.1	1.00 0.1	1.00 0.1	83.00
Project Total							240.00 8.0	161.00 7.1	161.00 7.1	161.00 7.1	723.00
820.001	UPDATE BACKCOUNTRY MANAGEMENT PLAN				N18 N20	PKBASE-NR RES	50.00 1.5	30.00 1.0	30.00 1.0	30.00 1.0	140.00
						PKBASE-NR INT	0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0.00
						PKBASE-NR MON	0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0.00
						PKBASE-NR PRO	0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0.00
						Subtotal	50.00 1.5	30.00 1.0	30.00 1.0	30.00 1.0	140.00

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PK	PROJECT	PROJECT TITL	PKG	CULT	SYSTEM-	FUNDING	ACT	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	
PRI	NUMBER		NUM	RES	WIDE	SOURCE	TYP					
				TYPE	ISSUE			\$\$ FTE	\$\$ FTE	\$\$ FTE	\$\$ FTE	
0	820.002	REVISE			N18 N20	PKBASE-NR RES		20.00 1.5	10.00 1.0	10.00 1.0	20.00 1.5	60
		COLORADO				PKBASE-NR INT		0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0
		RIVER				PKBASE-NR MON		0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0
		MANAGEMENT				PKBASE-NR PRO		0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0
		PLAN										
						Subtotal		20.00 1.5	10.00 1.0	10.00 1.0	20.00 1.5	60
						Project Total		70.00 3.0	40.00 2.0	40.00 2.0	50.00 2.5	200
0	830.001	UPDATE NEPA			N24	TEMP\$-NR ADM		100.00 4.0	0.00 0.0	0.00 0.0	0.00 0.0	100
		COMPLIANCE										
		FOR										
		WILDERNESS										
		RECOMMENDATI										
		O										
0	830.002	CONDUCT WILD			N12 N18	PKBASE-NR MON		3.00 0.1	0.0 0.0	0.0 0.0	3.00 1.5	6
		& SCENIC				TEMP\$-NR ADM		0.0 0.0	50.00 1.5	0.0 0.0	0.0 0.0	50
		RIVERS				PKBASE-NR ADM		0.0 0.0	0.0 0.0	3.00 1.5	0.0 0.0	3
		SUITABILITY										
		STUDY				Subtotal		3.00 0.1	50.00 1.5	3.00 1.5	3.00 1.5	55
						Project Total		103.00 4.1	50.00 1.5	3.00 1.5	3.00 1.5	155
0	800.004	ADAPTIVE			N12	PKBASE-NR MON		0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0
		MGMT &				FED-OTHER MIT		0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0
		LONG-TERM										
		MONITORING				Subtotal		0.00 0.0	0.00 0.0	0.00 0.0	0.00 0.0	0
		OF COLORADO										
		RV										
0	390.101	SUPPORT NPS			N13 N12	WATER-RES ADM		25.00 0.8	25.00 0.8	25.00 0.8	0.0 0.0	0
		WATER RIGHTS										
		CLAIMS FOR										
		LITTLE COL.										
		RIV										
0	640.402	RECLAMATION			N10	ENER-MIN MIT		350.00 0.1	0.0 0.0	0.0 0.0	0.0 0.0	3
		OF ORPHAN										
		MINE SITE										
0	610.101	INVENTORY			N20	FED-OTHER RES		10.00 0.2	10.00 0.2	10.00 0.2	10.00 0.2	0
		AND MAP PARK										
		SOILS										

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PROJECT NUMBER	PROJECT TITL NUM	PKG NUM	CULT RES	SYSTEM- WIDE TYPE	FUNDING SOURCE	ACT TYP	STARTING YEAR FTE	OUTYEAR 1 FTE	OUTYEAR 2 FTE	OUTYEAR 3 FTE	TOTAL FTE	TOTAL FTE
410.101	DEVELOP & MAINTAIN PALEO TOLOGI C LOCALITY DATABAS				N23	NR-I&M MON PKBASE-NR MON	30.00 0.3 0.0 0.0	0.0 0.0 5.00 0.1	0.0 0.0 5.00 0.1	0.0 0.0 5.00 0.1	0.0 0.0 5.00 0.1	30.00 15.00 45.00
210.105	MANAGE HABITUATED/B EGGAR WILDLIFE				N16	TEMP\$-NR MIT	25.00 0.5	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	25.00
210.103	DEVELOP SPECIFIC IPM PLAN				N04 N05	PKBASE-OT MIT	5.00 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	5.00
Project Total							30.00	0.5	0.00	0.0	0.00	30.00
200.201	IMPLEMENT MONITORING PROGRAM FOR ALL T&E&S SPECIES				N02	PKBASE-OT MON	40.00 1.0	40.00 1.0	40.00 1.0	40.00 1.0	40.00 1.0	160.00
210.104	INVENTORY & MONITOR VECTORS FOR HUMAN DISEASE				N24	PKBASE-OT MIT	15.00 0.5	15.00 0.5	15.00 0.5	15.00 0.5	15.00 0.5	60.00
410.102	INVENTORY AND PHOTODOCUMEN T PALEONTOLOGI C RESOURCES				N20 N23	PKBASE-NR MON	12.00 0.6	12.00 0.6	12.00 0.6	12.00 0.6	0.0 0.0	36.00
430.001	PREPARE A PALEONTOLOGI CAL RESOURCES MANAGEMENT PLAN				N20 N23	PKBASE-NR MON	12.00 0.6	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	12.00

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PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES	SYSTEM- WIDE	FUNDING SOURCE	ACT TYP	STARTING YEAR	OUTYEAR 1	OUTYEAR 2	OUTYEAR 3	TOTAL
			TYPE	ISSUE			\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	\$ \$ FTE	\$ \$

SENS. SPEC.

201.101	INVENTORY, MONITOR, MANAGE & PROTECT PARK MAMMALS		N20		RG-NS-RES RES		60.00 0.0	50.00 0.0	30.00 0.0	0.0 0.0	140.00
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810.002	REHABILITATI ON OF WILDERNESS RESOURCE IMPACTS		N18	N06	PKBASE-NR MIT		60.00 2.0	60.00 2.0	60.00 2.0	60.00 2.0	240.00
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105 projects printed

Grand Total	4807.00	89.9	4175.00	85.7	3506.70	80.0	2719.00	90.4	15207.70	3
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of data

APPENDIX

APPENDIX A

***Note: The GRCA research library has thousands of volumes of reference material on many natural and cultural issues affecting the park. A number of historic maps showing changes in the park are also included in the museum collection. A 16,000 black and white photographs, historical documents, park files, reports, archives, and historic building files are also available. This appendix is from the 1987 GRCA Resource Management Plan, and has not yet been updated to reflect this.*

INFORMATION BASELINE LIST: MAPS, PHOTOS, AND REFERENCES

1. Topography. U.S. Geological Survey maps of the entire park are on file in the Division of Resources Management office and are available as commercial sales items throughout the region. These maps include: twenty 15-minute quadrant maps (scale 1:62,500) covering the western end of the park; a 1-degree Grand Canyon National Park and Vicinity map (scale 1:62,500) covering the eastern section; and a series of 2-degree maps (scale 1:250,000) covering the Grand Canyon region.

To complement the topographic map files, the park maintains sets of aerial photographs. These include:

Project	Scale	Date
Park general (B&W)	1:36,000	1968
Vegetation Mapping (color)	1:24,000	1978
Colorado River Visitor Use/ Beach Impact Monitoring (B&W)	elevation: 500 feet and 2,000 feet	1981

2. Geology. A 1-degree map entitled Geology Map of the Grand Canyon National Park, Arizona (scale 1:62,500) is available as a sales item at various Grand Canyon Natural History Association (GCNHA) outlets within the park. This map was completed under a NHA-sponsored research contract in 1976. It covers the eastern end of the park and includes an area from Marble Canyon to approximately Havasupai Canyon. Preliminary geology maps of the remaining western end of the park at the same scale are on file at the Division of Resources Management office.

A thorough review of references pertaining to the geology of Grand Canyon National Park is available in the bibliographies identified in Appendix H.

3. Other. Individual maps needed for various resources management projects have been developed by the park staff using standard USGS topographic maps. These are on file under individual subject titles in the Division of Resources Management office. Subjects include: grazing exclosures, fire management zones, aircraft management zones, trails, fence projects, Colorado River campsite inventories, and water resources.
4. Wildlife. Grand Canyon National Park has no overall map showing wildlife distribution in the park. Information on the range and distribution of major wildlife species is contained in separate research reports and publications available in park files. These documents represent a variety of wildlife forms including: desert bighorn, mountain lion, humpback chub, Kaibab squirrels, peregrine falcons, and various reptiles, fish, and small mammals.

The park also has maps concerning deer pellet transect locations, boundaries of the old (1906) Grand Canyon Game Reserve, and feral burro distribution and home-range maps. These maps are on file at the Division of Resources Management office. Other information concerning the distribution and range of individual wildlife species within the park can be found in references listed in bibliographies identified in Appendix H.

5. Soils. A soils map of Grand Canyon National Park is not available. The need for a comprehensive soil survey is addressed in the Natural Resources Project Statement N-610.101. U.S. Forest Service soils maps entitled Tusayan District Soils Survey and North Kaibab District Soils Survey identify soils in lands adjoining the park along the Kaibab and Coconino plateaus, north and south of the park boundary.
6. Hydrology. Most of the hydrological features of the park can be found on appropriate USGS topographic maps. A water resource inventory is currently in progress within the park, and a partially completed map system delineating streams, springs, and seeps is available at the Division of Resources Management office. In his 1981 research report entitled "Analysis of Erosion Trends on Grand Canyon Beach Terraces," Dr. Robert Dolan included maps of 38 beach campsites on the Colorado River in Grand Canyon National Park. An overview of water resources in Arizona is presented in a map entitled "Drainages of Arizona Showing Perennial Streams and Some Important Wetlands," developed by the Arizona Game and Fish Department in 1978. The scale on this map is 1:1,000,000.
7. Climatology. Climatological data, compiled for five weather stations within the park, is available at the Division of Resources Management. Data date from 1903.
8. Vegetation. A 4-year study of the vegetation of Grand Canyon National Park was completed in 1981 by the Office of Arid Land Studies, University of Arizona at Tucson. This project resulted in four detailed vegetation maps encompassing the

entire park. These maps were developed in scale of 1:62,500. The 1:24,000 color aerial photographs identified above were developed as part of this project.

Earlier vegetation maps of portions of Grand Canyon National Park include a 1973 vegetation map of Point Sublime (scale 1:22,200) and two 1935 vegetation maps developed on topographic maps entitled "Grand Canyon National Park East Half" and "Grand Canyon National Park West Half" (scale 1:48,000). These 1935 maps include locations for approximately 300 photographs taken during the mapping projects.

In 1977 the Museum of Northern Arizona completed a contract research project involving a map of the riparian vegetation communities along the Colorado River. These maps were completed at a scale of 1:9,600 and are available at the Division of Resources Management office. The division also has maps entitled "The Natural Vegetative Communities of Arizona," (scale 1:500,000) developed by the Arizona Game and Fish Department, 1973, and "Biotic Communities of the Southwest," (scale 1:1,000,000) developed by David E. Brown and Charles H. Lowe of the U.S. Forest Service. These maps depict plant communities throughout the southwestern United States and northwestern Mexico.

9. Cultural. A complete collection of USGS 7.5 and 15-minute topographic quadrangle maps showing site locations and permanent site numbers are kept on file by the Division of Resources Management. Because of the sensitive nature of the data, these maps are not generally available to the public as specified in the Archaeological Resources Protection Act (P.L. 96-95). Areas which have been surveyed, and the locations of specific projects, are recorded on USGS maps at a scale of 1:250,000. Various other maps may be found with reports and publications listed in the reference and bibliography section of this plan. Site records for all 2700+ sites reside in resources management and microfiche at the Museum Collection.
10. Recreation, Development and Support Facilities. Maps relating to each of these elements are contained in a variety of management documents developed for the park. The most significant of these documents include:

- 1976 Final Master Plan and E.I.S.
- 1976 Park Suitability Study
- 1976 Proposed Wilderness Classification and Draft E.I.S.
- 1977 Development Concept Plan and E.I.S.
- 1977 Natural Resources Management Plan and Environmental Assessment
- 1978 Capacity Analysis/Water Management Alternatives
- 1979 Proposed Colorado River Management Plan and Final E.I.S.
- 1981 Draft Adjacent Lands Study
- 1980 Exhibit A; Wilderness Plan: Grand Canyon National Park [map]

Need to continue this list with projects since 1980!

Other documents offering the reader insight into the management of Grand Canyon National Park's recreation and development management programs include:

- 1972 Coconino and Yavapai (Cocopai) Resource Conservation and Development Project
- 1979 Northern Arizona Council of Governments Water Quality Management Plan
- 1979 Arizona Department of Health Services Rules and Regulations for Air Pollution Control
- 1980 Decision Report on B.L.M. Wilderness Review, Arizona
- 1981 The Secretarial Land Use Plan for the Addition to Havasupai Indian Reservation and Final E.I.S.

APPENDIX B

GRAND CANYON VEGETATION COMMUNITIES

In 1981 the park completed a 4-year research contract entitled: Grand Canyon National Park Vegetation Inventory. This project was the first phase of the park's Resources Base Inventory and was intended to provide the park with an accurate and detailed information baseline for its vegetative resources. The physical products resulting from this study included: a set of four detailed mylar vegetation maps (1:62,500) covering the entire National Park, descriptions of 104 vegetation mapping units (vegetation types), and a final report.

The classification system used for the vegetation mapping project was adopted from Brown, Lowe, and Pase (1979). It is a digitized, computer compatible system for natural vegetation in North America Following a six-level hierarchical format. For accuracy and detail in the Grand Canyon National Park project, two additional levels of identification were added to account for the variability of species found within plant associations and the spatial distribution of species within a vegetative type.

Vegetation types within the park were described in terms of vegetation associations, physiognomy, floristics, variation within types, and distribution. A Legend and Vegetation Description List for Grand Canyon National Park, along with an example of a Vegetation Typed Classification Sheet, is attached. A complete copy of the final report is available in the files of the Division of Resources Management, Grand Canyon National Park.

APPENDIX C

GRAND CANYON MAMMALS

SHREWS

Merriam's Shrew (Sorex merriami)
Dwarf Shrew (Sorex nanus)
Desert or Gray Shrew (Notiosorex crawfordi)

AMERICAN LEAF-NOSED BATS

California Leaf-nosed Bat (Macrotus californicus)

PLAINNOSE BATS

Yuma Myotis (Myotis yumanensis)
Arizona Myotis (Myotis lucifugus)
Long-eared Myotis (Myotis evotis)
Fringe-tailed Myotis (Myotis thysanodes)
Long-legged Myotis (Myotis volans)
California Myotis (Myotis californicus)
Small-footed Myotis (Myotis leibii)
Silver-haired Bat (Lasionycteris noctivagans)
Western Pipistrell (Pipistrellus hesperus)
Big Brown Bat (Eptesicus fuscus)
Red Bat (Lasiurus borealis)
Hoary Bat (Lasiurus cinereus)
Spotted Bat (Euderma maculatum)
Lump-nosed or Townsend's Big-eared Bat (Plecotus townsendii)
Allen's or Mexican Big-eared Bat (Idionycteris phyllotis)
Pallid Bat (Antrozous pallidus)

FREE-TAILED BATS

Mexican Free-tailed Bat (Tadarida brasiliensis)
Big Free-tailed Bat (Tadarida macrotis)

HARES AND RABBITS

Black-tailed Jack Rabbit (Lepus californicus)
Mountain or Nuttall's Cottontail (Sylvilagus nuttallii)
Desert Cottontail (Sylvilagus audubonii)

SQUIRRELS, CHIPMUNKS AND PRAIRIE DOGS

Whitetail or Gunnison's Prairie Dog (Cynomys gunnisoni)
Spotted Ground Squirrel (Spermophilus spilosoma)
Rock Squirrel (Spermophilus variegatus)
Harris' antelope Squirrel (Ammospermophilus harrisii)
White-tailed Antelope Squirrel (Ammospermophilus leucurus)
Golden-mantled Ground Squirrel (Spermophilus lateralis)
Least Chipmunk (Eutamias minimus)
Colorado chipmunk (Eutamias quadrivittatus)
Uinta Chipmunk (Eutamias umbrinus)
Cliff Chipmunk (Eutamias dorsalis)
Abert Squirrel (Sciurus aberti)
Kaibab Squirrel (Sciurus kaibabensis)
Red or Spruce Squirrel (Tamiasciurus hudsonicus)

POCKET GOPHERS

Common or Valley Pocket Gopher (Thomomys bottae)
Northern Pocket Gopher (Thomomys talpoides)

POCKET MICE AND KANGAROO RATS

Silky Pocket Mouse (Perognathus flavus)
Apache Pocket Mouse (Perognathus apache)
Little Pocket Mouse (Perognathus longimembris)
Arizona Pocket Mouse (Perognathus amplus)
Great Basin Pocket Mouse (Perognathus parvus)
Long-tailed Pocket Mouse (Perognathus formosus)
Rock Pocket Mouse (Perognathus intermedius)
Merriam's Kangaroo Rat (Dipodomys merriami)
Ord's Kangaroo Rat (Dipodomys ordii)
Chisel-toothed Kangaroo Rat (Dipodomys microps)

BEAVERS

Beaver (Castor canadensis)

NEW WORLD RATS AND MICE

Western Harvest Mouse (Reithrodontomys megalotis)
Canyon Mouse (Peromyscus crinitus)
Cactus Mouse (Peromyscus eremicus)
Deer Mouse (Peromyscus maniculatus)

Brush Mouse (Peromyscus boylii)
Pinyon Mouse (Peromyscus truei)
Northern Grasshopper Mouse (Onychomys leucogaster)
Southern Grasshopper Mouse (Onychomys torridus)
White-throated Wood Rat (Neotoma albigula)
Desert Wood Rat (Neotoma lepida)
Stephen's Wood Rat (Neotoma stephensi)
Mexican Wood Rat (Neotoma mexicana)
Bushy-tailed Vole (Microtus cinerea)
Long-tailed Vole (Microtus longicaudus)
Mexican Vole (Microtus mexicanus)
Muskrat (Ondatra zibethicus)

OLD WORLD MICE AND RATS

House Mouse (Mus musculus)

AMERICAN PORCUPINES

Porcupine (Erethizon dorsatum)

DOGS AND ALLIES

Coyote (Canis latrans)
Kit Fox (Vulpes macrotis)
Gray Fox (Urocyon cinereoargenteus)

BEARS

Black Bear (Ursus americanus)

RACCOONS AND ALLIES

Ringtail (Bassariscus astutus)
Raccoon (Procyon lotor)

WEASELS AND ALLIES

Long-tailed Weasel (Mustela frenata)
American Badger (Taxidea taxus)
Western Spotted Skunk (Spilogale gracilis)
Striped Skunk (Mephitis mephitis)
River Otter (Lutra canadensis)

CATS

Mountain Lion (Felis concolor)

Bobcat (Lynx rufus)

DEER

Elk or Wapiti (Cervus canadensis)

Mule Deer (Odocoileus hemionus)

Pronghorn Antelope (Antilocapra americana)

Desert Bighorn or Mountain Sheep (Ovis canadensis)

APPENDIX D

GRAND CANYON AMPHIBIANS AND REPTILES

	ABUNDANCE
<u>SALAMANDERS</u>	
Tiger Salamander (<u>Ambystoma</u> tigrinum)	Common
<u>SPADEFOOT TOADS</u>	
Western Spadefoot (<u>Scaphiopus</u> hammondi)	Rare
Great Basin Spadefoot (<u>Scaphiopus</u> intermontanus)	Common
<u>TRUE TOADS</u>	
Great Plains Toad (<u>Bufo</u> cognatus)	Hypothetical*
Red-spotted Toad (<u>Bufo</u> punctatus)	Abundant
Woodhouse's Toad (<u>Bufo</u> woodhousei)	Abundant
<u>TREE FROGS</u>	
Canyon Tree Frog (<u>Hyla</u> arenicolor)	Uncommon
<u>TRUE FROGS</u>	
Bullfrog (<u>Rana</u> catesbeiana)	Hypothetical*
Leopard Frog (<u>Rana</u> pipiens)	Rare
<u>TORTOISES</u>	
Desert Tortoise (<u>Gopherus</u> polyphemus)	Rare
<u>SOFTSHELL TURTLES</u>	
Texas Softshell (<u>Trionyx</u> spiniferus)	Hypothetical*
<u>GECKOS</u>	
Banded Gecko (<u>Coleonyx</u> variegatus)	Uncommon
<u>IGUANIDS</u>	
Gridiron-tailed Lizard (<u>Callisaurus</u> draconoides)	Rare

Collared Lizard (<u>Crotaphytus</u> collaris)	Common
Desert Collared Lizard (<u>Crotaphytus</u> insularis)	Common
Leopard Lizard (<u>Crotaphytus</u> wislizeni)	Rare
Crested Lizard (<u>Dipsosaurus</u> dorsalis)	Hypothetical*
Short-horned Horned Lizard (<u>Phrynosoma</u> douglassi)	Common
Snub-nosed Horned Lizard (<u>Phrynosoma</u> platyrhinos)	Rare
Chuckwalla (<u>Sauromalus</u> obesus)	Common
Sagebrush Lizard (<u>Sceloporus</u> graciosus)	Common
Desert Spiny Lizard (<u>Sceloporus</u> magister)	Abundant
Fence Lizard (<u>Sceloporus</u> magister)	Abundant
Western Brush Lizard (<u>Urosaurus</u> graciosus)	Hypothetical*
Tree Lizard (<u>Urosaurus</u> ornatus)	Common
Side-blotched Uta (<u>Uta</u> Stansburiana)	Abundant

VENOMOUS LIZARDS

Gila Monster (<u>Heloderma</u> suspectum)	Rare
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NIGHT LIZARDS

Yucca Night Lizard (<u>Xantusia</u> vigilis)	Rare
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WHIPTAILS AND THEIR ALLIES

Tessellated Race Runner (<u>Cnemidophorus</u> tigris)	Abundant
Plateau Whiptail (<u>Cnemidophorus</u> velox)	Uncommon

SKINKS

Many-lined Skink (<u>Eumeces</u> multivirgatus)	Common
Western Skink (<u>Eumeces</u> skiltonianus)	Uncommon

SLENDER BLIND SNAKES

Dwarf Blind Snake (<u>Leptotyphlops</u> humilis)	Rare
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COLUBRIDS

Glossy Snake (<u>Arizona</u> elegans)	Hypothetical*
Night Snake (<u>Hypsiglena</u> torquata)	Uncommon
King Snake (<u>Lampropeltis</u> getulus)	Common
Arizona Coral King Snake (<u>Lampropeltis</u> pyromelana)	Uncommon
Whip Snake (<u>Masticophis</u> flagellum)	Uncommon
Striped Whip Snake (<u>Masticophis</u> taeniatus)	Common

Gopher Snake (<u>Pituophis</u> melanoleucus)	Common
Long-nosed Snake (<u>Rhinoceilus</u> lecontei)	Common
Western Patch-nosed Snake (<u>Salvadora</u> hexalepis)	Uncommon
Utah Black-headed Snake (<u>Tantilla</u> planiceps)	Rare
Western Garter Snake (<u>Thamnophis</u> elegans)	Common
Sonora Lyre Snake (<u>Trimorphodon</u> lambda)	Rare

PIT VIPERS

Speckled Rattlesnake (<u>Crotalus</u> mitchelli)	Rare
Black-Tailed Rattlesnake (<u>Crotalus</u> molossus)	Rare
Mojave rattlesnake (<u>Crotalus</u> scutulatus)	Hypothetical*
Prairie Rattlesnake (<u>Crotalus</u> viridis)	Uncommon
Grand Canyon Rattlesnake (<u>Crotalus</u> viridis abyssus)	Uncommon

*Hypothetical: no record of species from park, but may occur by virtue of known range and habitat.

APPENDIX E

PREHISTORIC RUINS ON THE LIST OF CLASSIFIED STRUCTURES

NUMBER	TITLE
GC-1	Tusayan Ruin
GC-2	
GC-60	
GC-63	
GC-212	Walhalla Glades Ruin
Ariz. B:10:2	
Ariz. B:10:16	
Ariz. B:10:19	
Ariz. B:11:2	
Ariz. B:11:9	
Ariz. B:11:10	
Ariz. B:11:14	
Ariz. B:11:16	
Ariz. B:11:19	
Ariz. B:11:20	
Ariz. B:11:22	
Ariz. B:11:36	
Ariz. B:11:38	
Ariz. B:11:61	
Ariz. B:11:62	
Ariz. B:11:78	
Ariz. B:11:79	
Ariz. B:15:1A	LCS-1
Ariz. B:15:19	
Ariz. B:15:20	
Ariz. B:15:30	
Ariz. B:15:38	
Ariz. B:15:53	
Ariz. B:15:63	
Ariz. B:16:1	Bright Angel Pueblo
Ariz. B:16:2	
Ariz. B:16:3	
Ariz. B:16:4	
Ariz. B:16:5	
Ariz. B:15:14	
Ariz. B:16:15	
Ariz. B:16:18	

Ariz. B:16:24
Ariz. B:16:30
Ariz. B:16:31
Ariz. B:16:32
Ariz. B:16:34
Ariz. B:16:59
Ariz. B:16:65
Ariz. B:16:66
Ariz. B:16:71
Ariz. B:16:75
Ariz. C:5:1
Ariz. C:13:1
Ariz. C:13:2
Ariz. C:13:11
Ariz. C:13:18
Ariz. C:13:22
Ariz. C:13:34
Ariz. C:13:40
Ariz. C:13:41
Ariz. C:13:42
Ariz. C:13:43
Ariz. C:13:45
Ariz. C:13:54
Ariz. C:13:60

Point Sublime Ruin

Transcept Trail Run

Unkar Ruins

APPENDIX F

***Note: These are now in a new LCS Database! This appendix section does not yet relect all of these changes.*

LIST OF HISTORIC BUILDINGS AND STRUCTURES IN GRAND CANYON NATIONAL PARK

GRAND CANYON LODGE HISTORIC DISTRICT NORTH RIM

<u>Name of Structure</u> <u>Listing</u>	NPS#	LCS#	<u>National Register</u>
Budget Cabin	972	09329	X
Budget Cabin	973	09405	X
Budget Cabin	974	09406	X
Budget Cabin	975	09407	X
Budget Cabin	976	09408	X
Budget Cabin	977	09409	X
Budget Cabin	978	09410	X
Budget Cabin	979	09411	X
Budget Cabin	980	09412	X
Budget Cabin	981	09413	X
Budget Cabin	982	09414	X
Budget Cabin	983	09415	X
Budget Cabin	984	09337	X
Budget Cabin	985	09348	X
Budget Cabin	986	09354	X
Budget Cabin	987	09359	X
Budget Cabin	988	09324	X
Budget Cabin	989	09330	X
Budget Cabin	990	09338	X
Budget Cabin	991	09350	X
Budget Cabin	992	09355	X
Budget Cabin	993	09360	X
Budget Cabin	994	09319	X
Budget Cabin	995	09325	X
Budget Cabin	996	09331	X
Budget Cabin	997	09341	X
Budget Cabin	998	09351	X
Budget Cabin	999	09361	X

Budget Cabin	1,000	12105	X
Budget Cabin	1,001	09332	X
Budget Cabin	1,002	09343	X
Budget Cabin	1,003	09352	X
Budget Cabin	1,004	09367	X
Budget Cabin	1,005	09374	X
Budget Cabin	1,006	09379	X
Budget Cabin	1,007	09383	X
Budget Cabin	1,008	09368	X
Budget Cabin	1,009	09371	X
Budget Cabin	1,010	09375	X
Budget Cabin	1,011	09369	X
Budget Cabin	1,012	09372	X
Budget Cabin	1,013	09373	X
Budget Cabin	1,014	09376	X
Budget Cabin	1,015	09380	X
Budget Cabin	1,016	09385	X
Budget Cabin	1,017	09384	X
Budget Cabin	1,018	09320	X
Budget Cabin	1,019	09322	X
Budget Cabin	1,020	09327	X
Budget Cabin	1,021	09333	X
Budget Cabin	1,022	09344	X
Budget Cabin	1,023	09321	X
Budget Cabin	1,024	09323	X
Budget Cabin	1,025	09328	X
Budget Cabin	1,026	09353	X
Budget Cabin	1,027	09358	X
Budget Cabin	1,028	09357	X
Budget Cabin	1,029	09362	X
Budget Cabin	1,030	09356	X
Budget Cabin	1,031	09365	X
Budget Cabin	1,032	09364	X
Budget Cabin	1,033	09363	X
Budget Cabin	1,034	09340	X
Budget Cabin	1,035	09370	X
Budget Cabin	1,036	09366	X
Budget Cabin	1,037	09378	X
Budget Cabin	1,038	09377	X
Budget Cabin	1,039	09382	X
Budget Cabin	1,040	09381	X
Budget Cabin	1,041	09388	X
Budget Cabin	1,042	09387	X
Budget Cabin	1,043	09386	X

Budget Cabin	1,044	09392	X
Budget Cabin	1,045	09391	X
Budget Cabin	1,046	09390	X
Budget Cabin	1,047	09389	X
Budget Cabin	1,048	09396	X
Budget Cabin	1,049	09395	X
Budget Cabin	1,050	09394	X
Budget Cabin	1,051	09393	X
Budget Cabin	1,052	09399	X
Budget Cabin	1,053	09398	X
Budget Cabin	1,054	09397	X
Budget Cabin	1,055	09401	X
Budget Cabin	1,056	09400	X
Budget Cabin	1,057	09402	X
Budget Cabin	1,058	09404	X
Budget Cabin	1,059	09416	X
Budget Cabin #1			
/First Aid Stn.	1,061	09318	X
No. Budget Washroom	1,062	09310	X
So. Budget Washroom	1,063	09311	X
Dirty Linen Rm.			
/Horse Guide Cabin	1,064	09315	X
Garage/Wood Storage	1,065	09314	X
Budget Dirty Linen Rm.			
(hose house)	1,067	09313	X
Res./Linen Storage	1,068	09403	X
Deluxe Cabin	1,069	09417	X
Deluxe Cabin	1,070	09418	X
Deluxe Cabin	1,071	09419	X
Deluxe Cabin	1,072	09420	X
Deluxe Cabin	1,073	09421	X
Deluxe Cabin	1,074	09422	X
Deluxe Cabin	1,075	09423	X
Deluxe Cabin	1,076	09424	X
Deluxe Cabin	1,077	09425	X
Deluxe Cabin	1,078	09426	X
Deluxe Cabin	1,079	09427	X
Deluxe Cabin	1,080	09428	X
Deluxe Cabin	1,081	09429	X
Deluxe Cabin	1,082	09430	X
Deluxe Cabin	1,083	09431	X
Deluxe Cabin	1,084	09432	X
Deluxe Cabin	1,085	09433	X
Deluxe Cabin	1,086	09434	X

Deluxe Cabin	1,087	09435	X
Deluxe Cabin	1,088	09436	X
Deluxe Cabin	1,089	09437	X
Deluxe Cabin	1,090	09438	X
Deluxe Cabin	1,091	09439	X
Grand Canyon Lodge			
Exhibit Bldg.	1,092	09309	X
Trail Shelter	215	09463	X
Budget Clean			
Linen Romm	1066	09312	X

HEADQUARTERS DISTRICT
NORTH RIM

<u>Name of Structure</u> <u>Listing</u>	NPS#	LCS#	<u>National Register</u>
Residence	101	55426	X
Residence	102	55427	X
Garage	102A		X
Dormitory	111	55428	X
Plumbing & Electrical	55430		
Shop	123	55429	X
Machine & Blacksmith			
Shop	124	55430	X
Gas & Oil Station	125	55431	X
Fire equipment Shed	126	55432	X
Horse Barn	129	55433	X
Equipment Shed	171	55442	X
Shed	128	58528	
Toilet & Laundry	186	58529	
Generator Building	202	58530	
Residence	152	58523	X
Residence	155	58524	X
Residence	151	58522	X

NORTH RIM INN (GRAND CANYON INN) HISTORIC DISTRICT
NORTH RIM

<u>Name of Structure</u> <u>Listing</u>	NPS#	LCS#	<u>National Register</u>
North Rim Inn	917	55583	X
Exposed Frame Duplex			
Cabin	918	55584	X
Exposed Frame Duplex			
Cabin	919	55585	X
Exposed Frame Duplex			
Cabin	920	55586	X
Manager's Cabin	921	55587	X
Washroom			

(prev. women's dorm)	922	55588	X
Laundry & Firehose			
house	923	55589	X
Linen House	924	55590	X
NPS Cabin			
(Comfort Stn.)	925	09317	X
NPS Cabin/Duplex	926	09334	X
NPS Cabin/Duplex	927	09335	X
NPS Cabin/Duplex	928	09336	X
NPS Cabin/Duplex	929	09339	X
NPS Cabin/Duplex	930	09342	X
NPS Cabin/Duplex	931	09345	X
NPS Cabin/Duplex	932	09346	X
NPS Cabin/Duplex	933	09347	X
NPS Cabin/Duplex	934	09349	X
Stone Drinking Fountain	N/A	58525	
Exposed Frame Cabin #1			
(single)	935	55591	X
Exposed Frame Cabin #2			
(single)	936	55592	X
Exposed Frame Cabin #3			
(single)	937	55593	X
Exposed Frame Cabin #4			
(single)	938	55594	X
Exposed Frame Cabin #5			
(single)	939	55595	X
Exposed Frame Cabin #6			
(single)	940	55596	X
Exposed Frame Cabin #7			
(single)	941	55597	X
Exposed Frame Cabin #8			
(single)	942	55598	X
Exposed Frame Cabin #9			
(single)	943	collapsed 1/94	X
Exposed Frame Cabin #10			
(single)	944	55600	X
Exposed Frame Cabin #11			
(single)	945	55601	X
Exposed Frame Cabin #12			
(single)	946	55602	X
Exposed Frame Cabin #13			
(single)	947	55603	X
Exposed Frame Cabin #14			
(single)	948	55604	X

Exposed Frame Cabin #15 (single)	949	55605	X
Exposed Frame Cabin #16 (single)	950	55606	X
Exposed Frame Cabin #17 (single)	951	55607	X
Exposed Frame Cabin #18 (single)	952	55608	X
Exposed Frame Cabin #19 (single)	953	55609	X
Exposed Frame Cabin #20 (single)	954	55610	X
Exposed Frame Cabin #21 (single)	955	55611	X
Exposed Frame Cabin #22 (single)	956	55612	X
Exposed Frame Cabin #23 (single)	957	55613	X
Exposed Frame Cabin #24 (single)	958	55614	X
Exposed Frame Cabin #25 (single)	959	55615	X
Exposed Frame Cabin #26 (single)	960	55616	X
Exposed Frame Cabin #27 (single)	961	55617	X
(2) log restrooms	134 and 135	55434 & 55435	X
Drinking Fountain		55436	
(6) stone woodpile enclosures		55619 (all six)	X
North Rim Inn Camp- Ground & Amphitheater	57	55620	X

NO DISTRICT DESIGNATION
NORTH RIM

<u>Name of Structure</u> <u>Listing</u>	<u>NPS#</u>	<u>LCS#</u>	<u>National Register</u>
No. Rim Entrance Sta.	121	09443	
No. Rim Gate Residence	122	09444	
No. Rim Gate Residence			

Garage	122A	09445
Greenland Lake Salt Cabin		09461
Cave House	—	09462
North Rim Fire Lookout Cabin	—	58516
CCC Hill Storage Shed	—	58538
Angels Window Overlook	—	58539
Point Imperial Overlook	—	58540
Cape Royal Overlook	—	58541
Grand Canyon Lodge Walkways, Trails, Stairways & Overlooks	—	58542
Kanabownits Cabin	138	58532
Muav Saddle Cabin	139	58535
Dynamite Cache	140	58533
North Rim Fire Lookout	132	58517
Kanabownits Fire Lookout	144	585531

TOROWEAP (TUWEEP) DISTRICT
NORTH RIM

<u>Name of Structure Listing</u>	<u>NPS#</u>	<u>LCS#</u>	<u>National Register</u>
Toroweap Ranger Station	320	07664	
Toroweap Garage/Barn	321	07665	
Toroweap Root Cellar	343	58518	
Toroweap Water Catchment System Collector	—	58519	
Toroweap Ranger Station Stone Retaining Wall	—	58521	
Toroweap Water Catchment System Cistern	—	58520	

CORRIDOR DISTRICT
INNER CANYON

***Note: This list will be revised as a result of the current LCS work 7/94*

<u>Name of Structure</u> <u>Listing</u>	NPS#	LCS#	<u>National Register</u>
North Kaibab Trail		09454	X
Cottonwood Ranger Stn. and Residence	092	09441	X
<u>Phantom Ranch Structures</u>			
River Ranger Stn.	091		X
The Rock House	154		X
Mule Shelter & Corral	222	09451	X
Trailcrew Bunkhouse	870		X
Comfort Stn. (near Bunkhouse)	871		X
Corral (Fred Harvey)	872		X
Cowboy Dorm	875		X
Recreation Bldg.	878		X
Shower and Bathhouse	879		X
Guest Cabin	880		X
Guest Cabin	881		X
Guest Cabin	882		X
Manager's Cabin	883		X
Guest Cabin	884		X
Guest Cabin	885		X
Guest Cabin	886		X
Guest Cabin	887		X
Stone Cabin	888		X
Guest Cabin (stone/wood)	889		X
Stone Cabin	890		X
Stone Cabin	891		X
Dining Hall	892		X
Connecting River Trail		09456	X

Bright Angel Trail Designations

Bright Angel Trail		09455	X
Indian Gdns. Res. (Rock House)	018	09440	X

Indian Gdns. Ranger Res.	093	09442	X
Trailside Shelter (1-1/2 mi. house)	141	09446	X
Trailside Shelter (3 mi. house)	142	09447	X
Trailside shelter (Indian Gdns.)	143	09448	X
Trailside Shelter (Pipe Creek)	179		X

END of Bright Angel Trail Listings

So. Kaibab Trail		09453	X
Suspension Bridge (So. Kaibab Trail)		09452	X
Fossil Fern Exhibit Case	220	09450	X

GRAND CANYON VILLAGE HISTORIC DISTRICT
SOUTH RIM

***Note: This list will be revised as a result of the current LCS work 7/94*

<u>Name of Structure Listing</u>	<u>NPS#</u>	<u>LCS#</u>	<u>National Register</u>
Old Admin. Bldg./ Supt's. res.	001	12020	X
Ranger Dorm	076	07659	X
Operations Bldg.	103	07660	X
Old Post Office	166	07663	X
Buckey O'Neill Cabin	508		X
Red Horse Stage Stn.	526		X
Lookout Studio	532		X
Kolb Brothers Studio	533	07666	X
El Tovar Hotel	542		X
Hopi House	545		X
Verkamp's Curio Shop	546		X
Grand Canyon/ SF Railroad Depot	549		X
Blacksmith Shop	564		X

Grand Canyon Powerhouse	567		X
Kolb Garage	617	07667	X
Apache St. Residence	799		X
Apache St. Residence	800		X
Apache St. Residence	801		X
Apache St. Residence	802		X
Apache St. Residence	803		X
Apache St. Residence	804		X
Apache St. Residence	805		X
Apache St. Residence	806		X
Apache St. Residence	807		X
Apache St. Residence	808		X
Apache St. Residence	809		X
Apache St. Residence	810		X
Apache St. Residence	811		X
Apache St. Residence	812		X
Apache St. Residence	813		X
Apache St. Residence	814		X
Apache St. Residence	815		X
Apache St. Residence	816		X
Apache St. Residence	817		X
Apache St. Residence	818		X
Apache St. Residence	819		X
Apache St. Residence	820		X
Apache St. Residence	821		X
Apache St. Residence	822		X
Apache St. Residence	823		X
Bight Angel Lodge	507		X
Bright Angel Lodge Cabins	562		X
Fred Harvey Mule Barn	562		X
Fred Harvey Horse Barn	563		X

GRANDVIEW MINE HISTORIC DISTRICT
INNER CANYON

<u>Name of Structure</u> <u>Listing</u>	<u>NPS#</u>	<u>LCS#</u>	<u>National Register</u>
Stone Cabin (Horseshoe Mesa)		09457	X
Grandview Trail		09458	

INDIVIDUAL PROPERTIES
INNER CANYON

<u>Name of Structure</u> <u>Listing</u>	NPS#	LCS#	<u>National Register</u>
Water Disposal Plant		12021	X
Powell Memorial			
(West Rim Dr.)		12022	
Yavapai Pt. Museum			
Obsrvn. Stn.	110	07661	
Tusayan Museum			
(East Rim Dr.)	114	07662	
Hermit's Rest			
Concession Bldg.			X

APPENDIX G

BUILDINGS CONSTRUCTED PRIOR TO 1940 WHICH REQUIRE CONSIDERATION AS HISTORIC PROPERTIES WITHIN GRAND CANYON NATIONAL PARK

<u>INDIVIDUAL PROPERTY</u>	NPS#
Community Building	44
Fred Harvey Carpenter & Paint Shop	575
Shirley Hall (Dorm & Tack)	557
Telephone Office	500
Recreation Center	501
Fred Harvey Executive Residence	
Fred Harvey Executive Residence	
Fred Harvey Garage & General Office	551
Victor Hall 55495	576
Victor Hall Annex 55496	578
Residence	504
Residence	809
Residence	810
Residence	824
Fred Harvey Employee Cabins	595-608
Fred Harvey Employee Cabins	610-616
Fred Harvey Employee Cabins	581-589
Brown Building	537
Original Hospital	100
Old Schoolhouse	208
Middle School	227
Service Station/Auto Shop	
Fred Harvey Boiler House	630 (or 632A)
Visitor Information Bldg. at Mushwhip	
NPS Housing	2-7 & 9
NPS Housing	11-19 & 21
NPS Housing	46-48
NPS Housing	50-55
NPS Housing	66, 67
NPS Housing	159, 161
NPS Housing	163, 169
Labor Cabins	60-65
Boulder Street Houses	845-856
NPS Maintenance Area Bldgs. (11 total)	
Tusayan Museum Residence	

Supai Village	
Yaki Point Residence	
Yaki Point Barns & Sheds	
Desert View Watchtower	907
Fred Harvey Residence at Desert View	
NPS Residence at Desert View	
Hermit Trail	
Indian Gardens Pumphouse	
Colter Hall	539

INDIVIDUAL PROPERTY

Fred Harvey Laundry	
Fred Harvey Maintenance Bldg.	
Fuel Shed	101A
Administrative Offices	119
Equipment Shed	127
Residences	151, 152
Residences	153, 155
Residences	175, 177, 150
Residences	176, 178

APPENDIX H

3.0 Legend and Vegetation Descriptions for Grand Canyon National Park

3.1 The Hierarchical Legend

- 120 Forest and Woodland Formation
 - 121 Boreal Forests and Woodlands
 - 121.3 Rocky Mountain Subalpine Conifer Forest and Woodland
 - 121.31 Englemann Spruce - Alpine Fir Series
 - 121.31 Picea engelmannii - Abies lasiocarpa Association
 - 121.311 Picea engelmannii - Abies lasiocarpa
 - 121.317 Picea engelmannii - Mixed Conifer Association
 - 121.3171 Picea engelmannii - Mixed Conifer Aspen Subclimax
 - 122 Cold Temperature Forests and Woodlands
 - 122.3 Rocky Mountain Montane Conifer Forest
 - 122.32 Pine Series
 - 122.321 Pinus ponderosa Association
 - 122.3211 Pinus ponderosa with Mixed Shrub Understory
 - 122.3212 Pinus ponderosa with Forbs and Grasses
 - 122.3213 Pinus ponderosa - Populus tremuloides Subclimax
 - 122.322 Pinus ponderosa - Mixed Conifer - Populus tremuloides - Subclimax
 - 122.3221 Pinus ponderosa - Mixed Conifer - Populus tremuloides - Subclimax
 - 122.323 Pinus ponderosa - Quercus gambelii Association
 - 122.3231 Pinus ponderosa - Quercus gambelii and Robinia neomexicana
 - 122.3232 Pinus ponderosa - Quercus gambelii and Scleroscrub - Rim Type
 - 122.326 Pinus ponderosa - Picea engelmannii Association
 - 122.326 Pinus ponderosa - Picea engelmannii Association
 - 122.327 Pinus ponderosa - Abies concolor Association
 - 122.3271 Pinus ponderosa - Abies concolor - Populus tremuloides - Subclimax
 - 122.3272 Pinus ponderosa - Abies concolor -Deciduous Understory
 - 122.4 Great Basin Conifer Woodland
 - 122.41 Pinyon-Juniper Series
 - 122.414 Pinus edulis - Juniperus spp. Association
 - 122.4141 Pinus edulis - Juniperus spp. with Mixed Scleroscrub - Esplanade
 - 122.4142 Pinus edulis - Juniperus spp. with Mixed Shrub
 - 122.4143 Pinus edulis - Juniperus spp. with Artemisia tridentata and Chapparal
 - 122.4144 Pinus edulis - Juniperus spp. with Artemisia tridentata

- 122.4145 Pinus edulis - Juniperus spp. with Artemisia tridentata and Cowania mexicana
 - 122.4146 Pinus edulis - Juniperus spp. with Chaparral
 - 122.7 Rocky Mountain Deciduous Forest
 - 122.71 Aspen Series
 - 122.711 Populus tremuloides Association
- 130 Scrubland Formation
 - 132 Cold Temperature Scrublands
 - 132.1 Great Basin Montane Scrub
 - 132.1 Oak-Scrub Series
 - 132.111 Quercus gambelii Association
 - 132.1111 Quercus gambelii - Mesic Scrub
 - 132.1112 Quercus gambelii - Sclerophyllous Scrub
 - 133 Warm Temperature Scrublands
 - 133.3 Interior Chaparral
 - 133.32 Manzanita Series
 - 133.322 Arctostaphylos pungens Association
 - 133.3221 Arctostaphylos pungens - Mixed Shrub
- 140 Grassland Formation
 - 142 Cold Temperature Grasslands
 - 142.2 Great Basin Shrub - Grassland
 - 142.25 Great Basin Shrub - Grassland Disclimax Series
 - 142.251 Toroweap Valley Shrub - Grassland
 - 142.252 Shrub - Grassland Gutierrezia Disclimax
 - 142.4 Rocky Mountain Montane Grassland
 - 14.41 Mixed Meadow Series
- 150 Desertland Formation
 - 152 Cold Temperature Desertlands
 - 152.1 Great Basin Desertscrub
 - 152.11 Sagebrush Series
 - 152.111 Artemisia tridentata Association
 - 152.1111 Artemisia tridentata - Flats, Valleys, and Low Hills
 - 152.1112 Artemisia tridentata with Cowania mexicana and Pinus edulis, Juniperus spp.
 - 152.112 Artemisia tridentata - Mixed Scrub-Grass Association
 - 152.1121 Artemisia tridentata - Gutierrezia sarothrae, Ephedra, Mixed Shrubs
 - 152.1122 Artemisia tridentata - Mixed Desertscrub with Pinus/Juniperus
 - 152.13 Blackbrush Series
 - 152.131 Coleogyne ramosissima Association
 - 152.1311 Coleogyne ramosissima - Desertscrub, Talus Slopes
 - 152.1312 Coleogyne ramosissima - Desertscrub, Esplanade

- 152.16 Mixed Scrub Series
- 152.1621 Mixed Scrub Association
- 152.1622 Mixed Scrub with Grasses and Succulents - Soil Pockets, Esplanade
- 152.1623 Mixed Scrub with Scleroscrub, Succulents and

Pinus/Juniper

- 152.163 Mixed Desertscrub with Succulents - Toroweap Valley
- 152.17 Saltbush Series
- 152.172 Atriplex canescens Association
- 152.1721 Atriplex canescens with Mixed Desertscrub
- 152.2 Desertscrub Annual Disclimax - Great Basin
- 153 Warm Temperature Desertlands
 - 153.1 Mohave Desertscrub
 - 153.11 Creosotebush Series
 - 153.114 Larrea divaricata Mixed Desertscrub and Succulents Association
 - 153.12 Blackbush Series
 - 153.121 Coleogyne ramosissima
 - 153.1211 Coleogyne ramosissima - Acacia greggii - Tonto Association
 - 153.18 White Bursage - Brittlebush Series - Interior
 - 153.19 Desertscrub Series
 - 153.191 Desertscrub Associations
 - 153.1911 Desertscrub - Mixed Shrub - Vulcan's Throne
- 223 Warm Temperate Swamp and Riparian Forests
 - 233.2 Interior Southwestern Riparian Deciduous Forest and Woodland
 - 233.21 Cottonwood - Willow Series
 - 233.211 Populus fremontii - Salix spp. Association

APPENDIX I

Example of Vegetation Type Classification Sheet for Grand Canyon National Park

121.3111

Name: *Picea engelmanni* - *Abies lasiocarpa* (Engelmann Spruce - Alpine Fir) Association

Physiognomy:

Evergreen needle-leaved forest. Evenly distributed stands of mixed narrow-crown coniferous trees, 5 to 20 meters high with deciduous broadleaf trees, 5 to 20 meters high, spaced irregularly throughout. Variable ground cover composed of summer seasonal herbs and grasses or sedges. Small coniferous shrubs may be present. Total cover of this type is estimated to be 50-75 percent or sometimes greater with conifers sharing greatest prominence.

Floristics:*	Prominence	Frequency - %
Characteristics Species	Range	<u>(22 samples)</u>
<i>Picea engelmanni</i>	2-5	75-100
<i>Abies lasiocarpa</i>	2-4	75-100
<i>Populus tremuloides</i>	2-4	75-100
<u>Associated Species</u>		
<i>Juniperus communis</i>	1-3	50-75
<i>Pinus ponderosa</i>	1-3	50-75
<i>Pseudotsuga menziesii</i>	1-4	25-50
<i>Abies concolor</i>	1-4	25-50
<i>Robinia neomexicana</i>	3	0-75
<i>Carex</i> spp.	1-3	50-75
Herbs and grasses	1-3	0-25

Variation Within Type:

Picea engelmanni is generally more frequent within the type than is *Abies lasiocarpa*. Other conifer trees are present only when habitat conditions are favorable.

Distribution:

Kaibab Plateau, North Rim on Loam to silty loam soils derived from Kaibab limestone. Elevation 7,900-8,600 feet. North or northwest facing slopes (15-20 percent). This type is distributed among the *Pinus ponderosa* vegetation types (122.324 and 122.327) which

occupy ridges and south facing slopes of the same elevation. Representation of this type is on north or northwest facing slopes of Kanabownits Canyon on the North Rim.

*Nomenclature follows Arizona Flora, by T.H. Kearney and R.H. Peebles, 1951, University of California Press.

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(In Alphabetical Order)

7/94 Draft Resource Management Plan Section

Janet Balsom, Park Archeologist	Archeology, Ethnography, & Cultural Resource Admin.
Doug Brown, Compliance Coordinator	Historic Properties, Environmental Compliance
Carl Bowman, Physical Scientist	All Physical Resources
Greer Chesher, Interpretation Liaison	Scoping Session and Newsletter
Kim Crumbo, Resource Management Specialist	Recreational Resources & Wilderness
Anita Davis, Interpreter	Scoping Session
Jamie Donahoe, WRO	Historic Resources Management
Michael Ebersole, Air Operations Officer	Aircraft Overflights
Helen Fairley, Archeologist	Archeology
Roy Irving, Interpreter/Computer Specialist	All that RMP Software Data Input & Tables
Linda Mazzu, Resource Management Specialist	Vegetation Management (& Acting Division Chief)
Jerry Mitchell, YOSE	Scoping Session Facilitator
Amy Moore, SOAR Group	Miscellaneous charts, appendices, and attachments
Zehra Osman, RMP Coordinator	Cultural Landscapes, Chapters 1 & 2, Integrated Resource Program
John Ray, Resource Management Specialist	Wildlife Management
Carolyn Richard, Curator	Museum Collections
Vince Santucci, RMP Coordination Asst.	Greater Colorado Plateau Program, Project Statement Coord.
Mike Strunk, Alaska Regional Office	Scoping Session Facilitator

Please note! This list only represents those branch chiefs and staff members who were responsible for their sections in this document. Each of them were assisted by their staff, who are not mentioned here. Much of the work contained here was also generated at the Scoping Session held in February of 1994. We thank those who inspired and helped us with this document.

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Please do not make changes on any disks; respond only in written form! THANKS

Grand Canyon National Park
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